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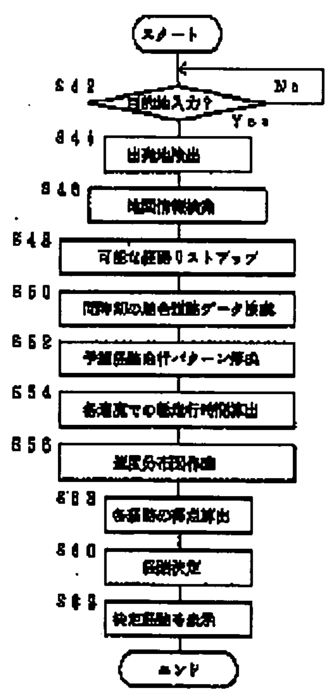
(54)【発明の名称】　車載用経路探索装置

(57)【要約】

【目的】　最短時間で目的地に到達する経路を探索できる車載用経路探索装置を提供する。

【構成】　交差点と交差点とを結ぶ結合道路を通過する毎に、速度変化のデータを記憶して置く。そして、現在位置から目的地までの経路を選択する際に、複数の経路を探索し（S48）、各経路の速度変化の予想経路走行パターンを結合道路毎の速度変化データに基づき形成する（S52）。そして、この予想経路走行パターンから各経路の得点を算出し（S58）、特定の最も高い、即ち、高い速度での走行時間が長く、信号における停止時間の短い経路を、推奨経路として決定し（S60）、経路案内を行う（S62）。



【特許請求の範囲】

【請求項1】　地図情報の記憶部、現在位置検出手段、および、目的地入力手段を含み現在位置から目的地までの経路を探索する車載用経路探索装置であって、
地図上の交差点とその位置座標、交差点間を接続する結合道路を記憶した道路網地図記憶手段と、
1つの結合道路を通過する毎の、走行速度の変化を記憶する速度変化記憶手段と、
現在位置から目的地までの距離的に短い経路を、前記記憶部に記憶された地図情報に基づき複数探索する経路探索手段と、
前記経路探索手段により探索された複数の経路の平均速度について、前記速度変化記憶手段に保持されている当該経路を構成する各結合道路における速度変化に基づき演算する平均速度演算手段と、
前記平均速度演算手段による演算結果に基づき、前記経路探索手段により探索された複数の経路において、平均速度の最も高い経路を選択する経路選択手段と、を備えたことを特徴とする車載用経路探索装置。

【請求項2】　地図情報の記憶部、現在位置検出手段、および、目的地入力手段を含み現在位置から目的地までの経路を探索する車載用経路探索装置であって、
地図上の交差点とその位置座標、交差点間を接続する結合道路を記憶した道路網地図記憶手段と、
1つの結合道路を通過する毎に、通過に要した時間を記憶する時間記憶手段と、
現在位置から目的地までの距離的に短い経路を、前記記憶部に記憶された地図情報に基づき複数探索する経路探索手段と、
前記経路探索手段により探索された複数の経路の所要時間について、前記時間記憶手段に保持されている当該経路を構成する各結合道路の通過時間に基づき演算する所要時間演算手段と、
前記所要時間演算手段による演算結果に基づき、前記経路探索手段により探索された複数の経路において、所要時間の最も短い経路を選択する経路選択手段と、を備えたことを特徴とする車載用経路探索装置。

【請求項3】　地図情報の記憶部、現在位置検出手段、および、目的地入力手段を含み現在位置から目的地までの経路を探索する車載用経路探索装置であって、
地図上の交差点とその位置座標、交差点間を接続する結合道路を記憶した道路網地図記憶手段と、
1つの結合道路を通過する毎に、走行速度の変化を記憶する速度変化記憶手段と、交差点において信号停止した時間を記憶する信号停止時間記憶手段と、結合道路において一旦停止した時間を記憶する一旦停止時間記憶手段と、
現在位置から目的地までの距離的に短い経路を、前記記憶部に記憶された地図情報に基づき複数探索する経路探索手段と、
前記経路探索手段により探索された複数の経路について、前記速度変化記憶手段に保持されている当該経路を構成する各結合道路における速度変化と、前記信号停止時間記憶手段に保持されている当該経路を構成する各結合道路における信号停止時間と、前記一旦停止時間記憶手段に保持されている当該経路を構成する各結合道路における一旦停止時間とに基づき評価する経路評価手段と、
前記経路評価手段による評価結果に基づき、前記経路探索手段により探索された複数の経路において、最も評価の高い経路を選択する経路選択手段と、を備えたことを特徴とする車載用経路探索装置。

【請求項4】　前記経路評価手段が、高い速度での走行時間が長く、信号停止時間と一旦停止時間とを合わせた停止時間が短いと共に、信号停止時間の短い経路を高く評価することを特徴とする請求項3の車載用経路探索装置。

【請求項5】　前記速度変化記憶手段と、前記信号停止時間記憶手段と、前記一旦停止時間記憶手段とが、予め設定された時刻単位でデータを記憶し、
前記経路評価手段が、経路の通過時刻又は、出発時刻に対応させて前記速度変化記憶手段と、前記信号停止時間記憶手段と、前記一旦停止時間記憶手段との時刻単位のデータに基づき経路の評価を行うことを特徴とする請求項3又は4の車載用経路探索装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、記録媒体に記録された地図情報を用いて、現在地より目的地までの経路を探索し、誘導する車載用経路探索装置に関するものである。

【0002】

【従来の技術】従来のナビゲーション装置における経路探索方法としては、経路の行程距離の最短のものを推奨経路として選択していた。ところが、交通量が多く、交差点通過頻度の高い経路を通過する際には、経路の選択の仕方によって信号停止の頻度が多くなる場合と、少なくなる場合とがあるため、短時間で目的地に到達するには、行程距離の短い経路よりも、交差点における信号停止の少ない経路を選択することが必要となる。そこで、交差点における信号停止時間を減少させる方法として、例えば、特開平5－128339号公報が提案されている。この方法では、路側ビーコンより信号機の位置と色変化とを受信する路側通信受信機を車両に搭載し、信号停止時間が最小となる速度範囲を算出して、走行速度がその範囲内になるように走行を制御するものである。

【0003】

【発明が解決しようとする課題】しかしながら、実際の道路、特に国道等の幹線道路においては朝夕の通勤時間帯、あるいは、昼間の交通量の多い時間帯には渋滞が発生することが多く、上記公報のように道路上の交差点の

信号機が青色点灯時間帯に通過するよう速度範囲を演算しても、経路あるいは走行する時間帯によって、その速度範囲内で走行することが不可能である場合が多く、交通量の多い道路においては、実際的ではなかった。

【0004】本発明は、上述した課題を解決するためになされたものであり、その目的とするところは、最短時間で目的地に到達する経路を探索できる車載用経路探索装置を提供することにある。

【0005】

【課題を解決するための手段】上記の目的を達成するため、本発明の請求項1の車載用経路探索装置では、地図情報の記憶部、現在位置検出手段、および、目的地入力手段を含み現在位置から目的地までの経路を探索する車載用経路探索装置であって、地図上の交差点とその位置座標、交差点間を接続する結合道路を記憶した道路網地図記憶手段と、1つの結合道路を通過する毎の、走行速度の変化を記憶する速度変化記憶手段と、現在位置から目的地までの距離的に短い経路を、前記記憶部に記憶された地図情報に基づき複数探索する経路探索手段と、前記経路探索手段により探索された複数の経路の平均速度について、前記速度変化記憶手段に保持されている当該経路を構成する各結合道路における速度変化に基づき演算する平均速度演算手段と、前記平均速度演算手段による演算結果に基づき、前記経路探索手段により探索された複数の経路において、平均速度の最も高い経路を選択する経路選択手段と、を備えたことを要旨とする。

【0006】また、請求項2の車載用経路探索装置では、地図情報の記憶部、現在位置検出手段、および、目的地入力手段を含み現在位置から目的地までの経路を探索する車載用経路探索装置であって、地図上の交差点とその位置座標、交差点間を接続する結合道路を記憶した道路網地図記憶手段と、1つの結合道路を通過する毎に、通過に要した時間を記憶する時間記憶手段と、現在位置から目的地までの距離的に短い経路を、前記記憶部に記憶された地図情報に基づき複数探索する経路探索手段と、前記経路探索手段により探索された複数の経路の所要時間について、前記時間記憶手段に保持されている当該経路を構成する各結合道路の通過時間に基づき演算する所要時間演算手段と、前記所要時間演算手段による演算結果に基づき、前記経路探索手段により探索された複数の経路において、所要時間の最も短い経路を選択する経路選択手段と、を備えたことを要旨とする。

【0007】また、上記の目的を達成するため、本発明の請求項3の車載用経路探索装置では、地図情報の記憶部、現在位置検出手段、および、目的地入力手段を含み現在位置から目的地までの経路を探索する車載用経路探索装置であって、地図上の交差点とその位置座標、交差点間を接続する結合道路を記憶した道路網地図記憶手段と、1つの結合道路を通過する毎に、走行速度の変化を記憶する速度変化記憶手段と、交差点において信号停止した時間を記憶する信号停止時間記憶手段と、結合道路において一旦停止した時間を記憶する一旦停止時間記憶手段と、現在位置から目的地までの距離的に短い経路を、前記記憶部に記憶された地図情報に基づき複数探索する経路探索手段と、前記経路探索手段により探索された複数の経路について、前記速度変化記憶手段に保持されている当該経路を構成する各結合道路における速度変化と、前記信号停止時間記憶手段に保持されている当該経路を構成する各結合道路における信号停止時間と、前記一旦停止時間記憶手段に保持されている当該経路を構成する各結合道路における一旦停止時間とに基づき評価する経路評価手段と、前記経路評価手段による評価結果に基づき、前記経路探索手段により探索された複数の経路において、最も評価の高い経路を選択する経路選択手段と、を備えたことを要旨とする。

【0008】また請求項4の車載用経路探索装置では、請求項3において、前記経路評価手段が、高い速度での走行時間が長く、信号停止時間と一旦停止時間とを合わせた停止時間が短いと共に、信号停止時間の短い経路を高く評価することを要旨とする。

【0009】また請求項5の車載用経路探索装置では、請求項3又は4において、前記速度変化記憶手段と、前記信号停止時間記憶手段と、前記一旦停止時間記憶手段とが、予め設定された時刻単位でデータを記憶し、前記経路評価手段が、経路の通過時刻又は、出発時刻に対応させて前記速度変化記憶手段と、前記信号停止時間記憶手段と、前記一旦停止時間記憶手段との時刻単位のデータに基づき経路の評価を行うことを要旨とする。

【0010】

【作用】請求項1の車載用経路探索装置では、1つの結合道路を通過する毎に、速度変化記憶手段に走行速度の変化を記憶しておく。即ち、通過した道路についての情報を保持する。そして、現在位置から目的地までの経路を選択する際に、経路探索手段により探索された複数の経路において、平均速度演算手段が、速度変化記憶手段に保持された当該経路を構成する各結合道路における走行速度の変化のデータに基づき各経路の平均速度を演算する。その後、経路選択手段が平均速度の最も高い経路を選択する。このため、最も高い速度で走行できる経路が選択される。

【0011】請求項2の車載用経路探索装置では、1つの結合道路を通過する毎に、時間記憶手段に通過に要した時間を記憶しておく。即ち、通過した道路についての情報を保持する。そして、現在位置から目的地までの経路を選択する際に、経路探索手段により探索された複数の経路において、所要時間演算手段が、時間記憶手段に保持された当該経路を構成する各結合道路における時間のデータに基づき、各経路の所要時間を演算する。その後、経路選択手段が所要時間の最も短い経路を選択する。このため、最短時間で目的地に到着できる経路が選

択される。

【0012】請求項3の車載用経路探索装置では、1つの結合道路を通過する毎に、速度変化記憶手段が走行速度の変化を記憶し、信号停止時間記憶手段が交差点において信号停止した時間を記憶し、一旦停止時間記憶手段が結合道路において一旦停止した時間を記憶する。即ち、通過した道路についての情報を保持しておく。現在位置から目的地までの経路を選択する際に、経路探索手段により探索された複数の経路について、経路評価手段が、速度変化記憶手段に保持されている当該経路を構成する各結合道路における速度変化と、信号停止時間記憶手段に保持されている当該経路を構成する各結合道路における信号停止時間と、一旦停止時間記憶手段に保持されている当該経路を構成する各結合道路における一旦停止時間とに基づき評価する。そして、経路選択手段が、経路評価手段による評価結果に基づき、複数の経路において、最も評価の高い経路を選択する。このため、最も適切な経路を選出することができる。

【0013】請求項4の車載用経路探索装置では、経路評価手段が、高い速度での走行時間が長く、信号停止時間と一旦停止時間とを合わせた停止時間が短いと共に、信号停止時間の短い経路を高く評価する。このため、走行速度が高く、信号での停止時間の短い経路を選択することができる。

【0014】請求項5の車載用経路探索装置では、速度変化記憶手段、信号停止時間記憶手段、及び一旦停止時間記憶手段が、予め設定された時刻単位でデータを記憶し、経路評価手段が、経路の通過時刻又は、出発時刻に対応させて速度変化記憶手段、信号停止時間記憶手段、及び、前記一旦停止時間記憶手段の時刻単位のデータに基づき経路の評価を行う。経路上での車の流れは時刻により変化するが、請求項5の車載用経路探索装置では、通行時間に合わせて最も適切な経路を選択することができる。

【0015】

【実施例】以下、本発明を具体化した実施例について図を参照して説明する。図1は、本発明の一実施例に係る車載用ナビゲーション装置の構成を示すブロック図である。この実施例では、自車位置の測定装置としてGPS受信機18を用いている。

【0016】GPS受信機18は、車両に取り付けられた専用アンテナ18aで受信した電波からデータを復調し、データ処理することにより自車位置を算出する。算出された自車位置データはCPU12へ送られる。なお、CPU12は、図示しないジャイロ及び車速センサからの出力によりGPS受信機18からの位置情報に補正を加えるようになっている。

【0017】CDROMプレーヤ30に装填されているCDROM(図示せず)には、地図を所定のフォーマットにデータ加工した地図データの他に、該地図上の交差点、その位置座標、交差点を接続する道路及び該接続道路の距離から成る結合道路データが含まれている。CDROMプレーヤ30は、該CDROMを再生して所望の地図データ及び結合道路データを読み出し、CPU12へ送る。

【0018】CPU12は、CDROMプレーヤ30に対して必要なデータを読み出させる。これにより読み出されたデータによって作成された地図画面データが、グラフィック・ディスプレイ・コントローラ(GDC)22を介してVRAM24に書き込まれる。GDC22は画面データをVRAM24に記憶させると共に、表示タイミング信号を発生してモニタ28に出力し、また、VRAM24に記憶されている画面データを読み出す信号を出力する。VRAM24から読み出されたデータの出力は、パレットDAC26でアナログRGB信号に変換されモニタ28にて画像として表示される。

【0019】CPU12は、上述したモニタによる画像表示と併せて上記地図データから抽出した制御信号(例えば、「500m先を左折」との音声信号に変換される制御信号)を音声出力装置36に与える。該音声出力装置36は、制御信号を音声信号に変換してスピーカ38から出力させる。

【0020】ROM14は、CPU12の作業手順(プログラム)や固定データが記憶されたメモリである。また、RAM16は、CPU12が各種の処理を進める際に必要に応じて使用する作業用メモリである。入力装置20は、目的地入力するための入力キーを備え、使用者が指により入力キーを押圧することにより車載用ナビゲーション装置の目的地の設定及び操作を行う装置であって、操作に応じた信号をCPU12へ送出する。また、受信機32は、渋滞、道路工事等の情報を受信してCPU12に送出する。

【0021】次に、第1実施例に係る車載用ナビゲーション装置の目的地設定の動作を図2乃至図12を参照して説明する。第1実施例の車載用ナビゲーション装置では、道路を通過する際に、その道路に関するデータを収集保持し、次回に経路を検索する際に、実際に通過した道路のデータに基づき走行パターンを予測して経路を決定する。ここでは、先ず、道路を通過する際のデータ収集について図8のフローチャートを参照し、車両が図2に示す出発地aから目的地bまでを移動する際のデータ収集を例に挙げて説明する。この車両は、出発地aから交差点B－1を通過し、交差点A－1を右折し後、交差点A－2、A－3、A－4、A－5を通過し、交差点A－6を左折して目的地bに到達するものとして説明を行う。この際に収集されるデータの内容を図5に、また、上記経路を通過中の速度パターンを図3に表す。

【0022】CPU12は、先ず現在時刻を確認する(S12)。即ち、データの収集を時刻と対応付けて行うためである。ここで、出発地aの出立時刻は午前9：

30であるため（図3参照）、午前9時のデータとして以降の測定値が保持される。次に、CPU12は現在位置及び進行方向に基づき、現在走行中の結合道路を認識する。ここでは、車両が図2に示す出発地ａと交差点B－1との間の結合道路ａ－B－1を走行しているため、結合道路はａ－B－1であることを認識する。この結合道路ａ－B－1は、結合道路の種別の他に走行方向も表示している。即ち、出発地ａから交差点B－1へ向かう場合には結合道路ａ－B－1となり、反対に交差点B－1から地点ａへ向かう場合には結合道路B－1－ａとなる。

【0023】次に、CPU12は走行パターンを記憶する。先ず、走行中かを判断し（S16）、ここでは、走行中であるため（S16がYes）、走行速度と時間とを図3に示す走行パターンデータ（km／hr×min）S1としてRAM16（図1参照）に保持する（S22）。次に、1つ分の結合道路分のデータを収集したかを判断し（S26）、1結合道路分のデータを収集していない場合には（S26がNo）、ステップ28へ移行して目的地に到着したかを判断するが、ここでは、目的地に到着していないため（S28がNo）、ステップ12に戻り、データの収集を続ける。

【0024】ここで、時刻9：32に交差点B－1を、信号機により停止することなく通過すると、交差点B－1から交差点A－1へ向かう結合道路B－1－A－1についての走行パターンデータS2の記録を開始する（S22）。ここで、結合道路ａ－B－1についての1結合道路分のデータを収集したため（S26がYes）、該結合道路に関するデータの平均値を後述するように算出する（S27）。そして、目的地に到着したかを判断するが（S28）、ここでは、目的地に到着していないため（S28がNo）、ステップ12に戻りデータの収集を続ける。

【0025】引き続き、時刻9：35に、交差点A－1を信号に停止することなく左折すると、交差点A－1から交差点A－2に向かう結合道路A－1－2についての走行パターンデータS3の記録を開始する（S22）。そして、時刻9：38に、交差点A－2を信号にて停止することなく通過すると、次に、交差点A－2から交差点A－3に向かう結合道路A－2－3についての走行パターンデータS4の記録を開始する（S22）。

【0026】この結合道路A－2－3（走行パターンデータS4）の走行中に、時刻9：40から時刻9：43まで渋滞によって一旦停止が発生したものとする。この場合には、CPU12は、図8に示すステップ16における走行中かの判断がNoとなり、現在位置が交差点の手前かを判断する（S18）。ここでは、交差点の手前の停止ではなく、交差点から離れた一旦停止であるため、該ステップ18がNoとなり、結合道路A－2－3での一旦停止時間として記憶する（S20）。そして、時刻9：43にて渋滞を通り抜けると、再び、ステップ16がYesとなり、走行パターンデータS4の記録を続ける（S22）。

【0027】その後、交差点A－4（結合道路A－4－5）において、時刻9：48から時刻9：50まで信号停止によって停止したものとする。この場合には、CPU12は、図8に示すステップ16における走行中かの判断がNoとなり、現在位置が交差点の手前かを判断する（S18）。ここでは、交差点の手前の停止であるため、該ステップ18がYesとなり、結合道路A－4－5における信号停止時間として記憶する（S24）。そして、時刻9：50にて、信号が青色となって該交差点A－4を通り抜けると、ステップ16がYesとなり、走行パターンデータS6の記録を開始する（S22）。

【0028】そして、地点ｂに到達し、運転者がイグニッションキーを抜くことにより、CPU12は、目的地到着と判断し（S28がYes）、データの収集処理が終了する。なお、上述した第1実施例では、経路中に設定されている法定速度50kmを越えるデータ値は、50kmとして記憶しているが、この代わりに法定以上の速度をそのまま保持することも可能である。

【0029】ここで、上述したステップ28における、平均値算出処理について当該ステップ28のサブルーチンを示す図9を参照して説明する。ここでは、上記結合道路ａ－B－1に関するデータの平均値算出処理を例に挙げて説明する。まず、CPU12は、この結合道路ａ－B－1の過去の平均値を呼び出し（S30）、そして、今回の測定値が、平均値に対して50％以上の偏差があるかを判断する（S32）。ここで、50％以上の偏差があった場合には（S32がYes）、今回収集したデータを還棄し、当該平均値算出処理を終了する。他方、50％以上の偏差がなかった場合には（S32がNo）、例えば、過去10回分の測定値から平均値を算出し、この値を後述する結合道路データとして保持する（S34）。即ち、10回以上古いデータを消去して、最近の10回の値から平均値を求めることにより、平均値を更新して交通の変化に対応し得るようにする。また、平均値を求める方法として単純に最近の10回の値から求める以外に、平日におけるデータ、あるいは、休日（土日祝日）におけるデータより最近の10回の値の平均値を別個に求めておくと、平日あるいは休日の運転に対してさらに適正なデータとなる。なお、この第1実施例では、交差点と交差点とを結ぶ道路を結合道路とするのみでなく、所定回数以上、出発地、目的地、中継地点としてナビゲーションの対象とされた会社、学校、自宅等から最寄りの交差点までの間の結合道路として処理するようになっている。

【0030】次に、上述した処理によって収集されたデータに基づく、第1実施例に係る車載用ナビゲーション装置の目的地設定の動作を図10に示すフローチャート

及び図1乃至図7を参照して説明する。CPU12は、先ず、入力装置20を介して目的地が入力されると（図10に示すS42がYes）、GPS受信機18からの信号に基づき現在位置（出発地）を検出する（S44）。

【0031】この後、CPU12は地図情報を検索する（S46）。即ち、入力された目的地と現在位置とを含む地図データをCDROMにアクセスして得ると共に、更に、目的地に最も近い交差点と現在位置に最も近い交差点とから、該地図データに含まれる交差点及び該交差点を接続する道路を、結合道路データを検索することにより得る。ここで、該CDROMに含まれる結合道路データに基づいて図2に示すような出発地aから目的地bまでを結ぶ間の交差点群を含む経路網を検索する。

【0032】そして、CPU12は、図2に示す交差点を結ぶ経路網から通行可能な経路を複数リストアップする（S48）。即ち、出発地aに最も近い交差点B－1から目的地bに最も近い交差点A－6までを結ぶ交差点群を選択し、この交差点群における各交差点を結ぶ距離を上記結合道路データ中の交差点間距離を積算することにより求める。ここで、最も距離の短い経路と、この最短経路よりも例えば5％までの範囲で距離の長い経路とを選択する。ここでは、最も距離の短い経路として地点a・交差点A－1・A－6・地点bの経路（以下第1経路と称する）が選択されたものとする。また、例えば、5％までの範囲で距離の長い経路として、地点a・交差点B－1・B－6・地点bの経路（以下第2経路と称する）が選択されたものとする。なお、最短経路から所定範囲長い距離の経路を選択する代わりに、出発地から目的地までの直線距離を求め、この直線距離の例えば10％を最短経路での距離に加えた距離内にある経路を選択することも可能である。

【0033】次にCPU12は、ステップ50にて、上記選択された第1経路及び第2経路のそれぞれについて、上述した走行中に収集したデータである結合道路データを検索する。ここでは、出発予定時刻が午前9：15であるため、午前9：00のデータを検索するものとする。先ず、第1経路（地点a・交差点A－1・A－6・地点bの経路）について、地点aから交差点B－1までの結合道路a－B－1、交差点B－1から交差点A－1までの結合道路B－1－A－1、交差点A－1から交差点A－2までの結合道路A－1－2、交差点A－2から交差点A－3までの結合道路A－2－3、交差点A－3から交差点A－4までの結合道路A－3－4、交差点A－4から交差点A－5までの結合道路A－4－5、交差点A－5から交差点A－6までの結合道路A－5－6、交差点A－6から地点b（目的地）までの結合道路A－6－bに関する結合道路データ（上述した過去10回の測定値の平均値）を検索し、このデータに基づき図3に示すような予想速度分布図を作成する（S52）。

なお、上述した説明では図3は、測定データとして参照したが、ここでは、便宜上測定データに基づく予想速度分布図として説明を行う。

【0034】なお、上述した説明では、データの収集の際の経路と、経路選択の際の経路とが一致している場合を例に挙げているが、この第1実施例では、結合道路データを結合道路単位に収集保持しているため、例え、出発地aから目的地bへ直接向ったことが過去に無くとも、出発地aから目的地bまでの各結合道路についての結合道路データが用意されていれば、上述した予想速度分布図を作成できる点に注意されたい。

【0035】CPU12は、引き続き、第2経路（地点a・交差点B－1・B－6・地点bの経路）について、地点aから交差点B－1までの結合道路a－B－1、交差点B－1から交差点B－2までの結合道路B－1－2、交差点B－2から交差点B－3までの結合道路B－2－3、交差点B－3から交差点B－4までの結合道路B－3－4、交差点B－4から交差点B－5までの結合道路B－4－5、交差点B－5から交差点B－6までの結合道路B－5－6、交差点B－6から交差点A－6までの結合道路B－6－A－6に、交差点A－6から地点bまでの結合道路A－6－bに関する結合道路データを検索し、このデータに基づき図4に示すような予想速度分布図を作成する（S52）

【0036】次にCPU12は、第1経路及び第2経路について、0km、10km、20km、30km、40km、50kmのそれぞれの速度での総走行時間を算出する（S54）。例えば、図3に示す第1経路の予想速度分布図を基に、50kmの切断ラインが速度パターンを通過している長さ（ここでは図中のd1－e1に相当）から、平均速度50kmでの総走行時間（3分）を算出し、また、40kmの切断ラインが速度パターンを通過している長さ（ここでは図中のc1－d2、e2－f1、g1－h1の合計に相当）から、平均速度40kmでの総走行時間（6分24秒）を算出し、また30Kmの切断ラインが速度パターンを通過している長さ（ここでは図中のi1－c2、f2－j1、k1－g2、h2－l1の合計に相当）から、平均速度30kmでの総走行時間（1分24秒）を算出する。同様にして、平均速度20km、10km、0kmでの総走行時間を算出する。なお、平均速度0kmについては、速度10km未満での走行時間および、一旦停止、信号停止等の停止時間の双方が含まれる。各平均速度における総走行時間の合計が地点aから地点bまでの経過時間、35分となる。

【0037】そして、CPU12は、第1経路及び第2経路のそれぞれについて、ステップ54で求めた各速度での走行時間に基づき、図7に示す速度分布図を作成する（S56）。ここで、図7（A）は第1経路の速度分布図を、図7（B）は第2経路の速度分布図を示してい

る。また、この速度分布図を構成する各速度における時間を合計することにより、第1経路及び第2経路における所要時間を求める。ここで第1経路は35分で、第2経路は30分として求まる。

【0038】CPU12は、第1経路及び第2経路の得点を求める（S58）。即ち、第1実施例では、単に所要時間が短いだけではなく、高い速度での走行時間が長く、信号停止時間と一旦停止時間とを合わせた停止時間が短いと共に、信号停止時間の短い経路を選択する。このため、それぞれの経路について、得点を求めて評価の対象とする。ここでは、ROM14（図2参照）に保持されている数式1に基づき得点を求める。なお、総走行時間の合計には10kmの走行時間も含まれるが、本実施例においてはこの走行時間の得点を0点として算出する。

【0039】

【数1】50km走行時　5×　分／2＝得点
40km走行時　4×　分／2＝得点
30km走行時　3×　分／2＝得点
20km走行時　2×　分／2＝得点
10km走行時　1×　分／2＝得点
10km未満走行時　0×　分／2＝得点
一旦停止時　　－1×　分／2＝得点
信号停止時　　－1．5×　分／2＝得点

【0040】例えば、第1経路については、50kmでの総走行時間が3分であるため得点が7．5点、40kmでの総走行時間が6．4分であるため得点が12．8点、30kmでの総走行時間が1．4分であるため得点が2．1点、20kmでの総走行時間が4．9分であるため得点が4．9点、10kmでの総走行時間が5．9分であるため得点が2．95点、渋滞による一旦停止が、図5に示すように3分であるため－1．5点、また、信号停止が図5に示すように4分あるため、－3点で、合計の得点が25．75点となる。なお、一旦停止よりも信号停止の場合に、マイナス点が高いのは信号による停止回数及び時間を減らすことを重視したもので、単に到着時間のみを問題にする場合には、一旦停止と信号停止とを識別せず同等に扱うことができる。他方、渋滞による一旦停止を避けることを目的とする場合には、信号停止よりも一旦停止の方をマイナス点を大きくする必要がある。

【0041】一方、第2経路については、50kmでの総走行時間が9分であるため得点が22．5点、40kmでの総走行時間が1．5分であるため得点が3点、30kmでの総走行時間が1．5分であるため得点が2．25点、20kmでの総走行時間が3分であるため得点が3点、10kmでの総走行時間が6分であるため得点が3点、渋滞による一旦停止が図6に示すよう無く、また、信号停止が図6に示すように3分あるため－2．25点で、合計の得点が31．5点となる。

【0042】CPU12は、上記ステップ58で求めた結果から、最も合計得点の高い経路を推奨経路として決定する（S60）。ここでは、合計得点が46．25点の第2経路が推奨経路とされる。そして、CPU12は、この決定した経路に従い経路案内を行う（S62）。即ち、読み出したデータによって作成した地図データに基づき経路案内用の地図をモニタ28に出力し、また、地図データから抽出した音声制御信号（例えば、「500m先を左折」）をスピーカ38から出力させる。ここで、第1実施例では、行程距離的にはより遠いが所要時間のより短い第2経路を通るようにナビゲーションを行うことにより、最短の時間で目的地bに到達させることができる。また、上記の例では速度の分布を10km毎としたが、5km、2km毎と細分化しても良い。

【0043】次に、本発明の第2実施例について、図11、図12のフローチャートを参照して説明する。上述した第1実施例では、走行時の走行速度と、停止時間とを別々にデータとして記録し、これらに基づいて経路の評価を行ったが、この第2実施例のナビゲーション装置は、各経路を構成する結合道路毎の速度と時間とを記憶し、この速度又は時間に基づき経路を決定する。

【0044】先ず、図11を参照して、第2実施例の車載用ナビゲーション装置における、道路を通過する際のデータの収集について説明する。なお、ここでは、車両が図2に示す出発地aから目的地bまでを移動する際のデータ収集について説明する。この車両は、出発地aから交差点B－1を通過し、交差点A－1を右折し後、交差点A－2、A－3、A－4、A－5を通過し、交差点A－6を左折して目的地bに到達するものとして説明を行う。

【0045】CPU12は、先ず現在時刻を確認する（S112）。ここで、現在時刻が午前9：30であるため、午前9時のデータとして以降の測定値が保持される。次に、CPU12は現在位置及び進行方向に基づき、現在走行中の結合道路を認識する。ここでは、図2に示す出発地aと交差点B－1との結合道路a－B－1を走行しているため、結合道路としてa－B－1を認識する。そして、出発地aを発ってからの交差点B－1に到着、又は、通過するまでの経過時間を記憶する（S116）。即ち、出発地aを出てから交差点B－1に到達するまでの経過時間を記憶する。

【0046】そして、CPU12は、地図データに含まれる出発地aから交差点B－1までの距離を上記経過時間で割ることにより平均速度を算出し（S118）、そして、算出した平均速度を記憶する（S120）。その後、図9を参照して上述したと同様にして最近の10回における平均値を算出して、結合道路データとして保持する（S122）。上記ステップ112からステップ122の処理を目的地bに到達するまで繰り返すことによ

り、目的地ｂまでの各結合道路についての結合道路データを収集する。

【0047】引き続き、第2実施例に係る車載用ナビゲーション装置の目的地設定の動作を図12に示すフローチャート及び図1及び図2を参照して説明する。CPU12は、先ず、入力装置20を介して目的地が入力されると（S142がYes）、現在位置（出発地）を検出する（S144）。

【0048】この後、CPU12は地図情報を検索する（S146）。即ち、入力された目的地と現在位置とを含む地図データをCDROMにアクセスして得ると共に、該地図データに含まれる交差点及び該交差点を接続する道路を、結合道路データを検索することにより得る。ここで、該CDROMに含まれる結合道路データに基づいて図2に示すような出発地ａから目的地ｂまでを結ぶ間の交差点群を含む経路網を検索する。

【0049】そして、CPU12は、図2に示す交差点を結ぶ経路網から通行可能な経路を複数リストアップする（S148）。即ち、第1実施例と同様に、通行可能な経路として地点ａ・交差点Ａ－1・Ａ－6・地点ｂの経路（第1経路）と、地点ａ・交差点Ｂ－1・Ｂ－6・地点ｂの経路（第2経路）とを選択する。

【0050】次にCPU12は、ステップ150にて、上記選択された第1経路及び第2経路を構成する結合道路について、上述した走行中に収集した結合道路データを検索する。ここでは、出発予定時刻が午前9：15であるため、第1経路と第2経路とについて午前9：00のデータを検索するものとする。

【0051】CPU12は、引き続き、第1経路及び第2経路のそれぞれについて、検索したデータに基づき、出発地ａを出発してから目的地ｂに到達するまでに必要な時間を算出する（S152）。ここでは、第1経路が35分、第2経路が30分として算出されたものとする。その後、第1経路及び第2経路について、検索した総走行距離と所要時間に基づき出発地ａから目的地ｂへの平均速度をを算出する（S154）。ここでは、第1経路が15ｋｍ／ｈｒ分、第2経路が17ｋｍ／ｈｒとして算出されたものとする。そして、CPU12は、ステップ152で求めた必要時間の短い方の経路、或いは、ステップ154で求めた平均速度の高い経路を選択する（S160）。その後、CPU12は、この決定した経路に従い経路案内を行う（S162）。

【0052】第1、第2実施例のナビゲーション装置は、実際に通過した経路について結合道路単位でデータを収集し、このデータに基づき経路を決定するために、最短の時間で目的地に到達し得る経路を選択することが可能となる。

【0053】また、第1実施例のナビゲーション装置では、走行時間の実データが経路探索に反映されるため、その道路の時間帯による特性を見逃すことがない。即ち、実際の走行に近似した走行パターンが予測できるため、より的確に最短経路が選択でき、車両の停止回数を少なくできる。このため、低燃費走行が可能となり、排気ガスを低減し得る。

【0054】この実施例のナビゲーション装置では、CPU12が決定を行った経路についてナビゲーションを行ったが、経路決定のプロセスを運転者に表示して経路に運転者に決定させるようにも構成できる。例えば、図3、図4の予想経路走行パターンや、図7に示す速度分布図をモニタ28に表示して、運転者に第1経路、第2経路のいずれかを選択させるようにも構成できる。また、上述した実施例では、出発予定時刻に対応させて、結合道路データを検索したが、この代わりに、各結合道路の通過予定時刻に対応させて結合道路を検索することも可能である。

【0055】

【効果】以上記述したように請求項1車載用ナビゲーション装置においては、平均速度の最も高い経路を選択するため、最も高い速度で走行できる経路を選択することができる。

【0056】請求項2の車載用経路探索装置では、所要時間の最も短い経路を選択するため、最短時間で目的地に到着できる経路を選択できる。

【0057】また、請求項3の車載用経路探索装置では、経路を構成する各結合道路における速度変化と、信号停止時間と、一旦停止時間とに基づき経路を評価するため、最適な経路を選出することができる。

【0058】さらに請求項4の車載用経路探索装置では、高い速度での走行時間が長く、信号停止時間と一旦停止時間とを合わせた停止時間が短いと共に、信号停止時間の短い経路を選択するため、走行速度が高く、信号での停止時間の短い経路を選択することができる。

【0059】請求項5の車載用経路探索装置では、測定したデータを時刻単位で記憶し、出発時刻に対応させて経路を選択するため、通行予定時間に合わせて最も適切な経路を選択することができる。

【図面の簡単な説明】

【図1】本発明の1実施例に係る車載用ナビゲーション装置の電気的構成を示すブロック図である。

【図2】第1実施例に係るナビゲーション装置により選択される経路を示す説明図である。

【図3】第1経路の予想経路走行パターンを示す説明図である。

【図4】第2経路の予想経路走行パターンを示す説明図である。

【図5】第1経路の結合道路データの内容を示す説明図である。

【図6】第2経路の結合道路データの内容を示す説明図である。

【図7】図7（Ａ）は第1経路の速度分布図を示する説

明図であり、図7（B）は、第2経路の速度分布図を示する説明図である。

【図8】第1実施例のナビゲーション装置の結合道路データの収集のため処理を示すフローチャートである。

【図9】図8に示す処理における平均値算出処理のサブルーチンを示すフローチャートである。

【図10】第1実施例に係るナビゲーション装置の経路探索処理を示すフローチャートである。

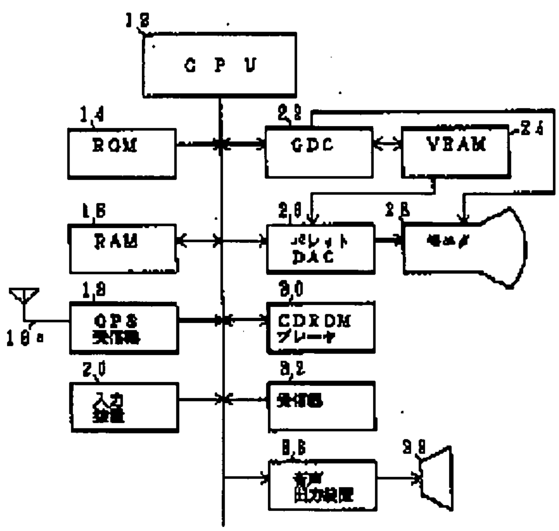
【図11】第2実施例のナビゲーション装置の結合道路データの収集のため処理を示すフローチャートである。

【図12】第2実施例に係るナビゲーション装置の経路探索処理を示すフローチャートである。

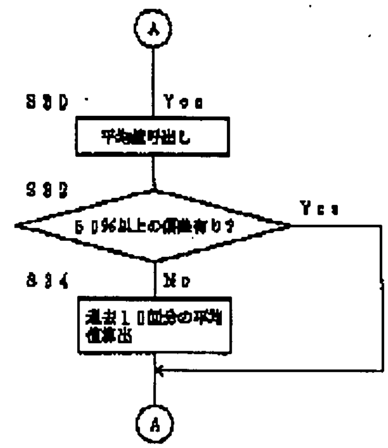
【符号の説明】

12　CPU
18　GPS受信機
28　モニタ
30　CDROMプレーヤ

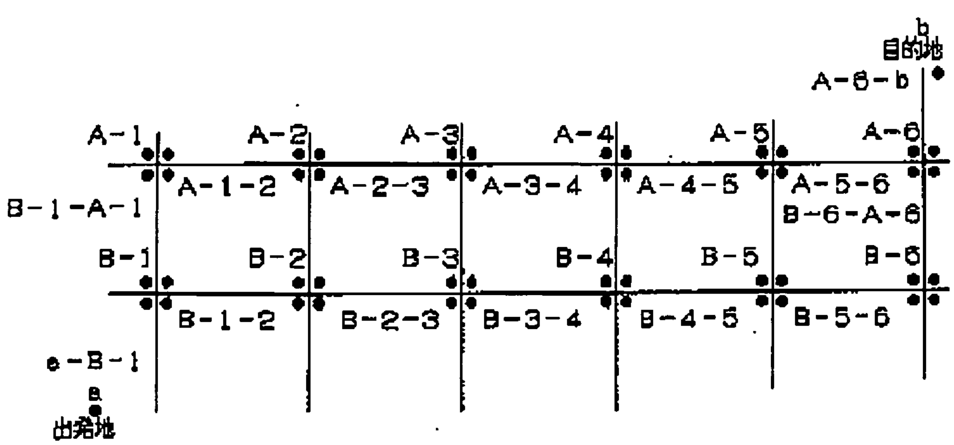
【図1】



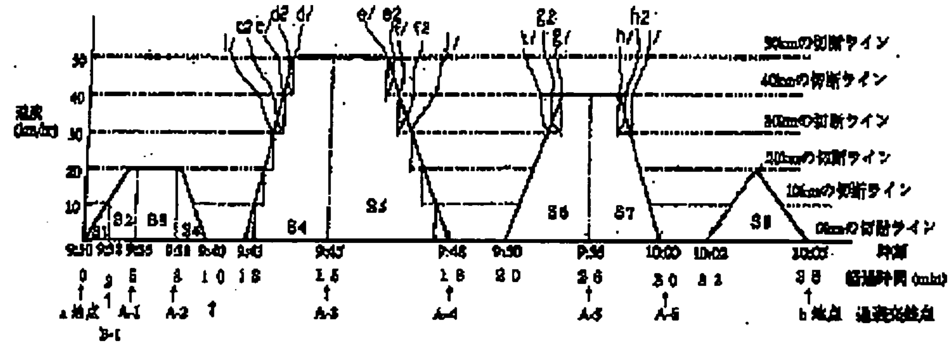
【図9】



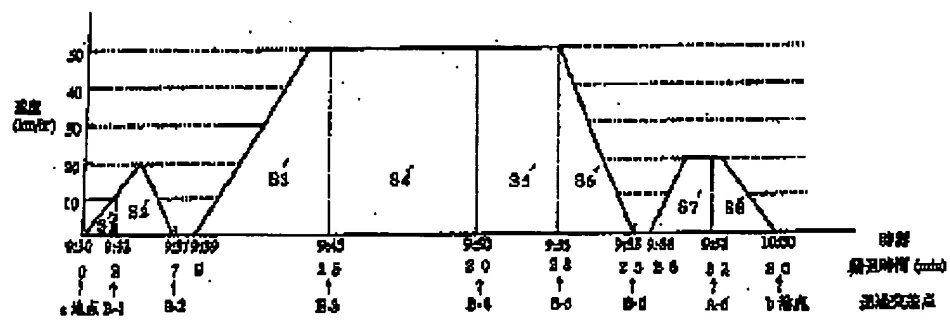
【図2】



【図3】



【図4】



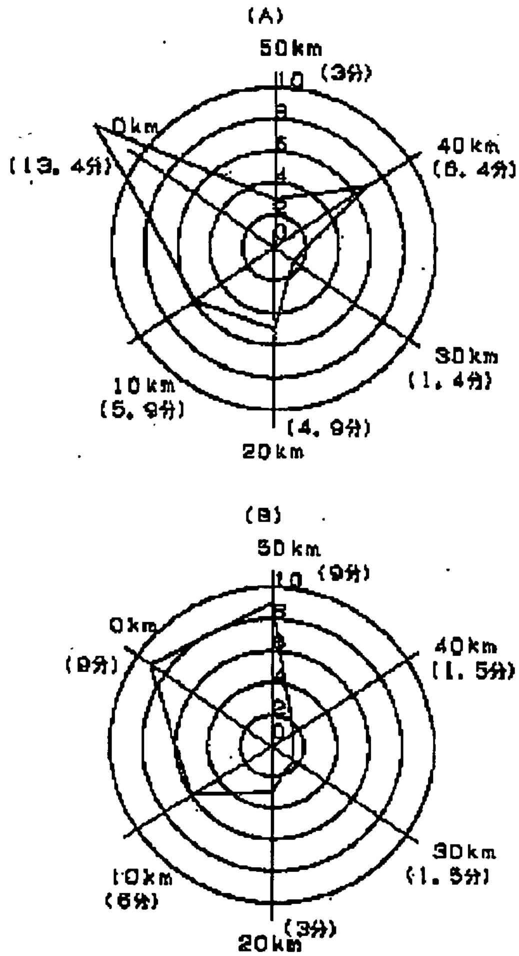
【図5】

時間帯（1時間刻み）		9:00								10:00	
交差点番号	地名および交差点番号	a	B-1	A-1	A-2	A-3	A-4	A-5	A-6	b	
結合道路情報	結合道路番号	a-B-1	B-1-A-1	A-1-2	A-2-3	A-3-4	A-4-5	A-5-6	A-6-b		
	走行パターン画像データ(km/hr×min)	S1	S2	S3	S4	S5	S6	S7	S8		行程所要時間(min)
	走行時間 (min)	2	3	3	4	3	6	4	3		
	一旦停止時間 (min)				3						
	信号停止時間 (min)						2		2		
	交差点間所要時間(min)	2	3	3	7	3	8	4	5		35

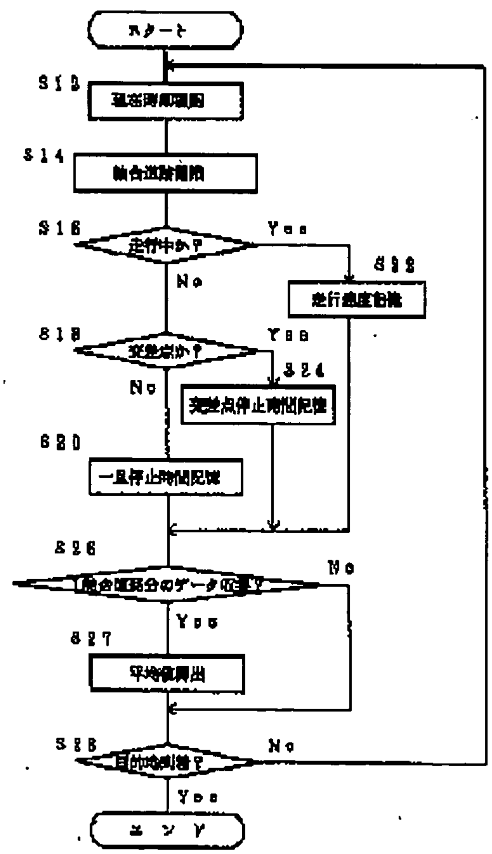
【図6】

時間帯（1時間刻み）		9：00								
交差点番号	地名および交差点番号	a	B-1	B-2	B-3	B-4	B-5	B-6	A-6	b
結合道路情報	結合道路番号	a-B-1	B-1-2	B-2-3	B-3-4	B-4-5	B-5-6	B-6-A-6	A-6-b	
	走行パターン画像データ(km/h×min)	S1′	S2′	S3′	S4′	S5′	S6′	S7′	S8′	行程所要時間(min)
	走行時間(min)	2	5	6	5	3	2	2	2	
	一旦停止時間(min)									
	信号停止時間(min)			2				1		
	交差点間所要時間(min)	2	5	8	5	3	2	3	2	30

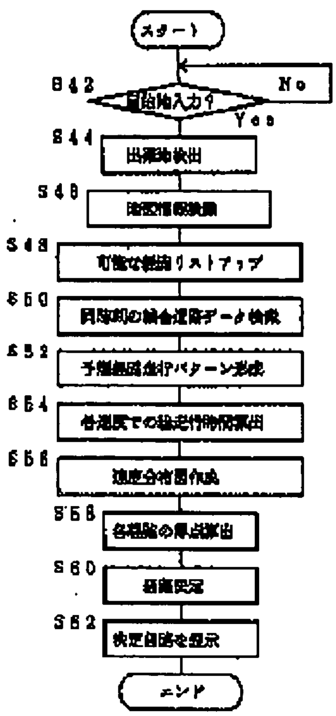
【図7】



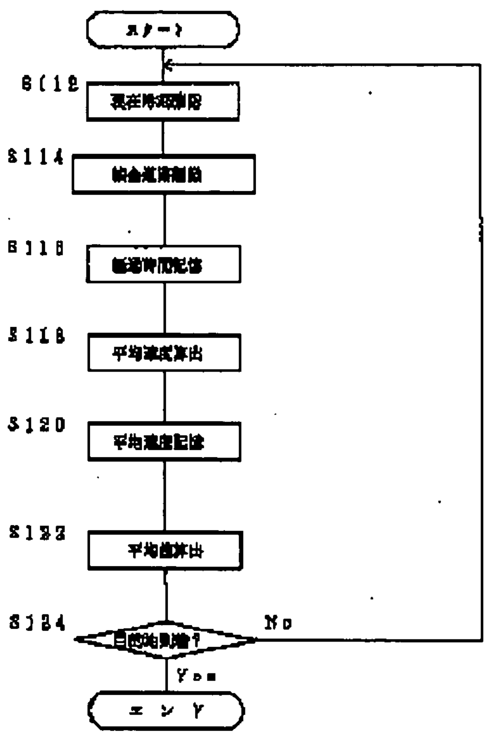
【図8】



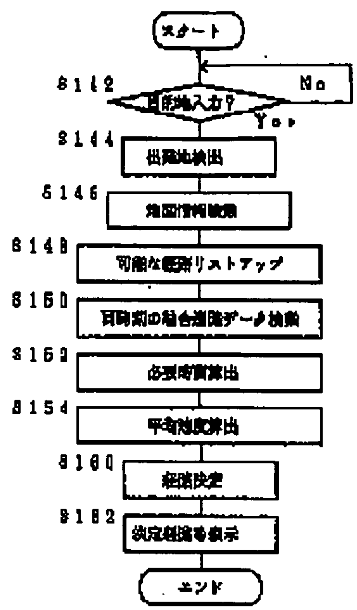
【図10】


スタート
S42
No
Yes
S44
出発地検出
S46
S48
可能な経路リストアップ
S50
S52
S54
S56
S58
S60
S62
エンド

【図11】


スタート
S112
S114
S116
S118
平均速度算出
S120
S122
平均値算出
S124
No
Yes
エンド

【図12】


スタート
S142
No
Yes
S144
出発地検出
S146
S148
可能な経路リストアップ
S150
S152
S154
S160
経路決定
S162
エンド

PATENT ABSTRACTS OF JAPAN

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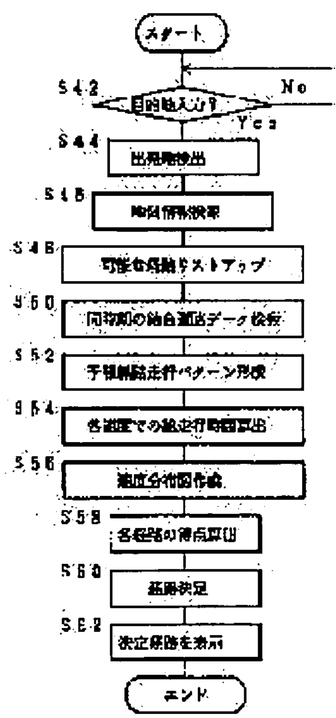
(72)Inventor : YOKOYAMA SHOJI
SUZUKI SEIICHI
HORI KOJI

(54) ON-VEHICLE ROUTE SEARCHING DEVICE

(57)Abstract:
PURPOSE: To provide an on-vehicle route searching device which can search a route to a destination in the shortest time.
CONSTITUTION: Whenever a vehicle passes a connection road connecting intersections to each other, speed change data are stored. At the time of selecting a route from a present location to a destination, a plurality of routes is searched (S48) and an estimated route running pattern indicating speed changes of each route is formed based on the speed change pattern of every connection road (S52). Then the mark obtained by each route is calculated from the estimated route running pattern (S58) and the route, of which mark is highest, that is, along which the running time at a specific high speed is longest and the stopping time at traffic signals is shortest is decided as a recommendable route (S60). Then, guidance is given in accordance with the recommendable route (S62).



LEGAL STATUS

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[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]	
[Date of final disposal for application]	
[Patent number]	3593749
[Date of registration]	10.09.2004
[Number of appeal against examiner's decision of rejection]	
[Date of requesting appeal against examiner's decision of rejection]	
[Date of extinction of right]	

* NOTICES *

CLAIMS

[Claim(s)]
[Claim 1] It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A rate change storage means to memorize change of ** which passes through one joint road of a travel speed, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, A mean velocity operation means to calculate based on the rate change in each joint road which constitutes the path concerned currently held at said rate change storage means about the mean velocity of two or more paths for which it was searched by said path planning means, Path planning equipment for mount characterized by having a routing means to choose the highest path of mean velocity, in two or more paths for which it was searched by said path planning means based on the result of an operation by said mean velocity operation means.
[Claim 2] It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A time amount storage means to memorize the time amount which passage took whenever it passes through one joint road, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, A duration operation means to calculate based on the pass time of each joint road which constitutes the path concerned currently held at said time amount storage means about the duration of two or more paths for which it was searched by said path planning means, Path planning equipment for mount characterized by having a routing means to choose the shortest path of a duration, in two or more paths for which it was searched by said path planning means based on the result of an operation by said duration operation means.
[Claim 3] It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A rate change storage means to memorize change of a travel speed whenever it passes through one joint road, A signal stop-time storage means to memorize the time amount which carried out a signal halt at the crossing, A stop time amount storage means to memorize the time amount stopped by the joint road, A path planning means to search for two or more paths short in distance

from the current position to the destination based on the map information memorized by said storage section, The rate change in each joint road which constitutes the path concerned currently held at said rate change storage means about two or more paths for which it was searched by said path planning means, The signal stop time in each joint road which constitutes the path concerned currently held at said signal stop-time storage means, A path evaluation means to evaluate based on the stop time amount in each joint road which constitutes the path concerned currently held at said stop time amount storage means, Path planning equipment for mount characterized by having a routing means to choose the path in which evaluation is the highest, in two or more paths for which it was searched by said path planning means based on the evaluation result by said path evaluation means.
[Claim 4] Path planning equipment for mount of claim 3 with which said path evaluation means is characterized by esteeming the short path of a signal stop time while the transit time in a high rate is long and the stop time with which a signal stop time and stop time amount were doubled is short.
[Claim 5] Said rate change storage means, said signal stop-time storage means, and said stop time amount storage means memorize data in the time-of-day unit set up beforehand. Said path evaluation means The passage time of day of a path Or claim 3 or 4 path planning equipment for mount which are characterized by making it correspond to departure time and evaluating a path based on the data of the time-of-day unit of said rate change storage means, said signal stop-time storage means, and said stop time amount storage means.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the path planning equipment for mount which searches for and guides the path to the destination from a its present location using the map information recorded on the record medium.
[0002]
[Description of the Prior Art] As the path planning approach in conventional navigation equipment, the shortest thing of the stroke distance of a path was chosen as a recommendation path. However, there is much traffic, and since the frequency of a signal halt by the method of selection of a path may increase or decrease in case the path in which crossing passage frequency is high is passed, in order to arrive at the destination for a short time, it is necessary to choose a path with few signal halt in a crossing than the path in which stroke distance is short. Then, JP,5-128339,A is proposed as an approach of decreasing the signal stop time in a crossing. The road-side communication receiver which receives the location of a signal and color change from a road-side beacon is carried in a car, the speed range where a signal stop time serves as min is computed, and transit is controlled by this approach so that a travel speed becomes within the limits of it.
[0003]
[Problem(s) to be Solved by the Invention] In trunk roads, such as an actual road, especially a national highway, however, the commuting time band of every morning and evening, Or even if it calculates speed range so that delay may occur in a time zone with much traffic of day ranges in many cases and the signal of the crossing on a course may pass in a blue lighting time zone like the above-mentioned official report It was impossible to have run in the speed range by the path or the time zone it runs in many cases, and it was not practical by the road with much traffic.
[0004] The place which it is made in order that this invention may solve the technical problem mentioned above, and is made into the purpose is to offer the path planning equipment for mount which can search for the path which arrives at the destination by the shortest time amount.
[0005]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, with the path planning equipment for mount of claim 1 of this invention It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A rate change storage means to memorize change of ** which passes through one joint road of a travel speed, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, A mean velocity operation means to calculate based

on the rate change in each joint road which constitutes the path concerned currently held at said rate change storage means about the mean velocity of two or more paths for which it was searched by said path planning means, Let it be a summary to have had a routing means to choose the highest path of mean velocity, in two or more paths for which it was searched by said path planning means based on the result of an operation by said mean velocity operation means.

[0006] With the path planning equipment for mount of claim 2, moreover, the storage section of map information, a current position detection means, And a road-system map storage means by which are path planning equipment for mount which searches for the path from the current position to the destination including a destination input means, and the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A time amount storage means to memorize the time amount which passage took whenever it passes through one joint road, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, A duration operation means to calculate based on the pass time of each joint road which constitutes the path concerned currently held at said time amount storage means about the duration of two or more paths for which it was searched by said path planning means, Let it be a summary to have had a routing means to choose the shortest path of a duration, in two or more paths for which it was searched by said path planning means based on the result of an operation by said duration operation means.

[0007] In order to attain the above-mentioned purpose, moreover, with the path planning equipment for mount of claim 3 of this invention It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A rate change storage means to memorize change of a travel speed whenever it passes through one joint road, A signal stop-time storage means to memorize the time amount which carried out a signal halt at the crossing, A stop time amount storage means to memorize the time amount stopped by the joint road, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, The rate change in each joint road which constitutes the path concerned currently held at said rate change storage means about two or more paths for which it was searched by said path planning means, The signal stop time in each joint road which constitutes the path concerned currently held at said signal stop-time storage means, A path evaluation means to evaluate based on the stop time amount in each joint road which constitutes the path concerned currently held at said stop time amount storage means, Let it be a summary to have had a routing means to choose the path in which evaluation is the highest, in two or more paths for which it was searched by said path planning means based on the evaluation result by said path evaluation means.

[0008] Moreover, with the path planning equipment for mount of claim 4, in claim 3, said path evaluation means makes it a summary to esteem the short path of a signal stop time, while the transit time in a high rate is long and the stop time with which a signal stop time and stop time amount were doubled is short.

[0009] Moreover, with the path planning equipment for mount of claim 5, it sets to claim 3 or 4. Said rate change storage means, said signal stop-time storage means, and said stop time amount storage means memorize data in the time-of-day unit set up beforehand. Said path evaluation means The passage time of day of a path Or let it be a summary to make it correspond to departure time and to evaluate a path based on the data of the time-of-day unit of said rate change storage means, said signal stop-time storage means, and said stop time amount storage means.

[0010]

[Function] With the path planning equipment for mount of claim 1, whenever it passes through one

joint road, change of a travel speed is memorized for the rate change storage means. That is, the information about the road through which it passed is held. And in case the path from the current position to the destination is chosen, in two or more paths for which it was searched by the path planning means, the mean velocity of each path is calculated based on the data of change of the travel speed in each joint road where a mean velocity operation means constitutes the path concerned held at the rate change storage means. Then, a routing means chooses the highest path of mean velocity. For this reason, the path it can run at the highest rate is chosen.

[0011] With the path planning equipment for mount of claim 2, whenever it passes through one joint road, the time amount which passage took is memorized for the time amount storage means. That is, the information about the road through which it passed is held. And in case the path from the current position to the destination is chosen, in two or more paths for which it was searched by the path planning means, the duration of each path is calculated based on the data of the time amount in each joint road where a duration operation means constitutes the path concerned held at the time amount storage means. Then, a routing means chooses the shortest path of a duration. For this reason, the path which can arrive at the destination by the shortest time amount is chosen.

[0012] With the path planning equipment for mount of claim 3, whenever it passes through one joint road, a rate change storage means memorizes change of a travel speed, the time amount in which the signal stop-time storage means carried out a signal halt at the crossing is memorized, and the time amount which the stop time amount storage means stopped by the joint road is memorized. That is, the information about the road through which it passed is held. The rate change in each joint road where a path evaluation means constitutes the path concerned currently held at the rate change storage means about two or more paths for which it was searched by the path planning means in case the path from the current position to the destination is chosen, It evaluates based on the signal stop time in each joint road which constitutes the path concerned currently held at the signal stop-time storage means, and the stop time amount in each joint road which constitutes the path concerned currently held at the stop time amount storage means. And a routing means chooses the path in which evaluation is the highest, in two or more paths based on the evaluation result by the path evaluation means. For this reason, the most suitable path can be elected.

[0013] A path evaluation means esteems the short path of a signal stop time by the path planning equipment for mount of claim 4, while the transit time in a high rate is long and the stop time with which a signal stop time and stop time amount were doubled is short. For this reason, a travel speed is high and can choose the short path of the stop time in a signal.

[0014] A rate change storage means, a signal stop-time storage means, and a stop time-amount storage means memorize data in the time-of-day unit set up beforehand, and a path evaluation means makes it correspond to the passage time of day or the departure time of a path, and evaluates a path by the path-planning equipment of claim 5 for mount based on the data of the time-of-day unit of a rate change storage means, a signal stop-time storage means, and said stop time-amount storage means. Although the flow of the vehicle on a path changes with time of day, it can choose the most suitable path with the path planning equipment for mount of claim 5 according to passing time amount.

[0015]

[Example] Hereafter, the example which materialized this invention is explained with reference to drawing. Drawing 1 is the block diagram showing the configuration of the navigation equipment for mount concerning one example of this invention. In this example, GPS receiver 18 is used as a measuring device of a self-vehicle location.

[0016] GPS receiver 18 computes a self-vehicle location by restoring to them and carrying out data processing of the data from the electric wave received by exclusive antenna 18a attached in the car. The computed self-vehicle location data are sent to CPU12. In addition, CPU12 adds amendment to

positional information from GPS receiver 18 with the output from the gyroscope which is not illustrated and a speed sensor.

[0017] The joint road data which consist of the distance of the road which connects the crossing on this map, its position coordinate, and crossing other than the map data which carried out data processing of the map at the predetermined format, and this connection road are contained in CDROM (not shown) with which the CDROM player 30 is loaded. The CDROM player 30 reproduces this CDROM, reads desired map data and joint road data, and sends them to CPU12.

[0018] CPU12 makes required data read to the CDROM player 30. The map screen data created with the data read by this are written in VRAM24 through the graphic display controller (GDC) 22. GDC22 outputs the signal which reads the screen data which generate a display timing signal, and output to a monitor 28, and are memorized by VRAM24 while making VRAM24 memorize screen data. The output of the data read from VRAM24 is changed into the analog RGB signal by the pallet DAC 26, and is displayed as an image with a monitor 28.

[0019] CPU12 gives the control signal (for example, control signal changed into the sound signal "500m beyond is turned left") which combined with the image display by the monitor mentioned above, and was extracted from the above-mentioned map data to an audio output device 36. This audio output device 36 changes a control signal into a sound signal, and is made to output it from a loudspeaker 38.

[0020] ROM14 is the memory work habits (program) and fixed data of CPU12 were remembered to be. Moreover, RAM16 is working-level month memory used if needed, in case CPU12 advances various kinds of processings. An input unit 20 is equipped with the input key for carrying out a destination input, when a user presses an input key with a finger, is equipment which performs a setup and actuation of the destination of the navigation equipment for mount, and sends out the signal according to actuation to CPU12. Moreover, a receiver 32 receives information, such as delay and road repairing, and sends it out to CPU12.

[0021] Next, actuation of a destination setup of the navigation equipment for mount concerning the 1st example is explained with reference to drawing 2 thru/or drawing 12 . In case collection maintenance of the data about the road is carried out in case it passes through a road, and a path is searched with the navigation equipment for mount of the 1st example next time, a transit pattern is predicted based on the data of the road through which it actually passed, and a path is determined. Here, first, about the data collection at the time of passing through a road, the data collection at the time of a car moving with reference to the flow chart of drawing 8 at from the origin a shown in drawing 2 to the destination b is mentioned as an example, and is explained. This car passes through a crossing B-1 from Origin a, turns a crossing A-1 to the right, passes a crossing A-2, A-3, A-4, and A-5 the back, and explains as what turns a crossing A-6 left and arrives at Destination b. In this case, the contents of the data collected are expressed to drawing 5 , and a rate pattern while passing the above-mentioned path is expressed to drawing 3 .

[0022] CPU12 checks current time first (S12). That is, it is for matching collection of data with time of day, and performing it. here -- a start of Origin a -- since time of day is 9:30 a.m. (refer to drawing 3), subsequent measured value is held as data at 9:00 a.m. Next, CPU12 recognizes the joint road under current transit based on the current position and a travelling direction. Here, since the car is running joint road a-B -1 during Origin a and the crossing B-1 which are shown in drawing 2 , it recognizes that a joint road is a-B -1. This joint road a-B -1 also shows the transit direction besides the classification of a joint road. That is, in going to a crossing B-1 from Origin a, it becomes joint road a-B -1, and it is set to joint road B-1-a in going to Point a from a crossing B-1 on the contrary.

[0023] Next, CPU12 memorizes a transit pattern. First, it judges whether it is [be / it] under transit (S16), and since it is under transit (S16 is Yes), it holds to RAM16 (refer to drawing 1) here as transit

pattern data (km/hrxmin) S1 which show a travel speed and time amount to drawing 3 (S22). Next, it judges whether the data for a joint road for one were collected (S26), when the data for 1 joint road are not being collected, it judges whether (S26 shifted to No) and step 28 and arrived at the destination, but since it has not arrived at the destination (S28 is No), collection of return and data is continued to step 12 here.

[0024] Here, if it passes through a crossing B-1 at time of day 9:32, without stopping with a signal, record of the transit pattern data S2 about the joint road B-1-A-1 which go to a crossing A-1 from a crossing B-1 will be started (S22). Here, since the data for 1 joint road about joint road a-B -1 were collected (S26 is Yes), it computes so that the average of the data about this joint road may be mentioned later (S27). And although it judges whether it arrived at the destination (S28), since it has not arrived at the destination (S28 is No), collection of return data is continued to step 12 here.

[0025] Then, if it turns left, without stopping a crossing A-1 to a signal to time of day 9:35, record of the transit pattern data S3 about the joint road A-1-2 which go from a crossing A-1 at a crossing A-2 will be started (S22). And if it passes without stopping a crossing A-2 by signal at time of day 9:38 next, record of transit pattern data S4 about the joint road A-2-3 which goes from a crossing A-2 at a crossing A-3 will be started (S22).

[0026] During transit of this joint road A-2-3 (transit pattern data S4), the stop should occur by delay from time-of-day 9:40 to time-of-day 9:43. In this case, that decision serves as No during the transit in step 16 which shows CPU12 to drawing 8 , and the current position judges whether it is before intersectional (S18). Here, since it is not a halt before intersectional but the stop which is distant from a crossing, this step 18 serves as No and it memorizes as stop time amount in the joint road A-2-3 (S20). And if it passes through delay at time of day 9:43, again, step 16 will serve as Yes and will continue record of transit pattern data S4 (S22).

[0027] Then, at the crossing A-4 (joint road A-4-5), it should stop by signal halt from time-of-day 9:48 to time-of-day 9:50. In this case, that decision serves as No during the transit in step 16 which shows CPU12 to drawing 8 , and the current position judges whether it is before intersectional (S18). Here, since it is a halt before intersectional, this step 18 serves as Yes and it memorizes as a signal stop time in the joint road A-4-5 (S24). And if a signal becomes blue and it passes through this crossing A-4 at time of day 9:50, step 16 will serve as Yes and will start record of the transit pattern data S6 (S22).

[0028] And when it arrives at Point b and an operator extracts an ignition key, CPU12 is judged to be destination arrival (S28 is Yes), and collection processing of data ends it. In addition, although the data value exceeding 50km in legal rate set up into the path is memorized as 50km in the 1st example mentioned above, it is also possible to instead hold the rate beyond authorization by law as it is.

[0029] Here, the average-value calculation processing in step 28 mentioned above is explained with reference to drawing 9 which shows the subroutine of the step 28 concerned. Here, averaging processing of the data about above-mentioned joint road a-B -1 is mentioned as an example, and is explained. First, CPU12 calls the average of the past of this joint road a-B -1 (S30), and judges whether this measured value has 50% or more of deflection to the average (S32). Here, when there is 50% or more of deflection, (S32 abandon Yes) and the data collected this time, and end the averaging processing concerned. On the other hand, when 50% or more of deflection cannot be found, (S32 compute an average value from the measured value of No), for example, past 10 batch, and hold as joint road data which mention this value later (S34). That is, the average is updated and it enables it to correspond to change of traffic by eliminating data old 10 times or more, and calculating the average from 10 times of the latest values. Moreover, besides asking from 10 times of the latest values simply as an approach of calculating an average value, if the average value of 10 times of the latest values is separately calculated from the data in a weekday, or the data in a holiday (Saturdays-and-Sundays

public holiday), it will become still more proper data to operation of a weekday or a holiday. In addition, it not only makes into a joint road the road which connects a crossing and a crossing, but in this 1st example, it processes more than the count of predetermined as a joint road of a before [a nearby crossing] from an origin, the destination, the firm where it considered as the object of navigation as a junction point, a school, a house, etc.

[0030] Next, it explains with reference to the flow chart and drawing 1 thru/or drawing 7 which shows the actuation of a destination setup of the navigation equipment for mount concerning the 1st example based on the data collected by processing mentioned above to drawing 10 . First, CPU12 will detect the current position (origin) based on the signal from GPS receiver 18, if the destination is inputted through an input unit 20 (S42 shown in drawing 10 is Yes) (S44).

[0031] Then, CPU12 retrieves map information (S46). That is, while accessing CDROM and obtaining map data including the inputted destination and the current position, the road which connects the crossing and this crossing which are included in these map data is acquired from the crossing still nearer to the destination, and the crossing nearest to the current position by searching joint road data. Here, the path network containing a crossing group while connecting from the origin a as shown in drawing 2 based on the joint road data contained in this CDROM to the destination b is searched.

[0032] And CPU12 lists two or more paths through which it can pass from the path network to which the crossing shown in drawing 2 is connected (S48). That is, the crossing group which connects from the crossing B-1 nearest to Origin a to the crossing A-6 nearest to Destination b is chosen, and the distance which connects each crossing in this crossing group is found by integrating the distance during a crossing in the above-mentioned joint road data. Here, the path in which distance is long is chosen from the path in which distance is the shortest, and this shortest path, in the range to 5%. Here, the path (the 1st path is called below) of point a, crossing A-1, A-6, and point b should be chosen as a path in which distance is the shortest. Moreover, the path (the 2nd path is called below) of point a, crossing B-1, B-6, and point b should be chosen as a path in which distance is long, in the range to 5%, for example. in addition, the predetermined range from the shortest path -- it is also possible to choose the path in the distance which found the slant range from an origin to the destination, and applied 10% of this slant range to the distance in the shortest path instead of choosing the path of a long distance.

[0033] Next, CPU12 searches with step 50 the joint road data which are data collected during the transit mentioned above about each of the 1st path by which selection was made [above-mentioned], and the 2nd path. Here, since the ETD is 9:15 a.m., the data of 9:00 shall be searched in the morning. first, about the 1st path (path of point a, crossing A-1, A-6, and point b) Joint road a-B -1 from Point a to a crossing B-1, the joint road B-1-A-1 from a crossing B-1 to a crossing A-1, the joint road A-1-2 from a crossing A-1 to a crossing A-2, the joint road A-2-3 from a crossing A-2 to a crossing A-3, The joint road data about joint road A-6-b from the joint road A-3-4 from a crossing A-3 to a crossing A-4, the joint road A-4-5 from a crossing A-4 to a crossing A-5, the joint road A-5-6 from a crossing A-5 to a crossing A-6, and a crossing A-6 to Point b (destination) (The average value of the past 10 times of the measured value mentioned above) is searched, and an anticipation velocity profile as shown in drawing 3 based on this data is created (S52). In addition, in the explanation mentioned above, although drawing 3 was referred to as measurement data, it explains as an anticipation velocity profile based on measurement data for convenience here.

[0034] In addition, although the case where the path in the case of collection of data and the path in the case of routing are in agreement is mentioned as the example in the explanation mentioned above Since collection maintenance of the joint road data is carried out per joint road in this 1st example, having not gone to Destination b in the past directly from a metaphor and Origin a -- ** -- if the joint

road data about each joint road from Origin a to Destination b are prepared, be careful of the point which can create the anticipation velocity profile mentioned above.

[0035] Succeedingly CPU12 about the 2nd path (path of point a, crossing B-1, B-6, and point b) Joint road a-B -1 from Point a to a crossing B-1, the joint road B-1-2 from a crossing B-1 to a crossing B-2, the joint road B-2-3 from a crossing B-2 to a crossing B-3, the joint road B-3-4 from a crossing B-3 to a crossing B-4, On the joint road B-4-5 from a crossing B-4 to a crossing B-5, the joint road B-5-6 from a crossing B-5 to a crossing B-6, and the joint road B-6-A-6 from a crossing B-6 to a crossing A-6 The joint road data about joint road A-6-b from a crossing A-6 to Point b are searched, and an anticipation velocity profile as shown in drawing 4 based on this data is created (S52).

[0036] Next, CPU12 computes the total with a rate [each] (0km, 10km, 20km, 30km, 40km, and 50km) transit time about the 1st path and the 2nd path (S54). for example, 50km cutting Rhine from the die length (here, equivalent to d1-e1 in drawing) which has passed the rate pattern based on the anticipation velocity profile of the 1st path shown in drawing 3 From the die length (here, equivalent to the sum total of c1-d2 in drawing, e2-f1, and g1-h1) to which the total transit time (3 minutes) with a mean velocity of 50km was computed, and 40km cutting Rhine has passed the rate pattern From the die length (here, equivalent to the sum total of i1-c2 in drawing, f2-j1, k1-g2, and h2-l1) to which the total transit time (6 minutes and 24 seconds) with a mean velocity of 40km was computed, and 30km cutting Rhine has passed the rate pattern The total transit time (24 seconds per minute) with a mean velocity of 30km is computed. Similarly, the total transit time (the mean velocity of 20km, 10km, and 0km) is computed. In addition, about the mean velocity of 0km, the both sides of stop times, such as the transit time with a rate of less than 10km and a stop, and a signal halt, are included. The sum total of the total transit time in each mean velocity becomes the elapsed time from Point a to Point b, and 35 minutes.

[0037] And CPU12 creates the velocity profile shown in drawing 7 about each of the 1st path and the 2nd path based on the transit time in each rate found at step 54 (S56). Here, drawing 7 (A) shows the velocity profile of the 1st path, and drawing 7 (B) shows the velocity profile of the 2nd path. Moreover, the duration in the 1st path and the 2nd path is found by totaling the time amount in each rate which constitutes this velocity profile. The 1st path is 35 minutes here and the 2nd path can be found as 30 minutes.

[0038] CPU12 asks for the score of the 1st path and the 2nd path (S58). That is, in the 1st example, the transit time in a high rate is long, and a duration is not only short, but while the stop time with which a signal stop time and stop time amount were doubled is short, it chooses the short path of a signal stop time. For this reason, in quest of a score, it considers as the object of evaluation about each path. Here, it asks for a score based on the formula 1 currently held at ROM14 (refer to drawing 2). In addition, although the 10km transit time is also included in the sum total of the total transit time, in this example, the score of this transit time is computed as zero point.

[0039]

[Equation 1] the time of 50km transit 5x a part -- /2= score 40km transit -- the time -- 4x At the time of a part / 30km transit of 2= scores 3x At the time of part / 20km transit of 2= scores 2x At the time of a part / 10km transit of 2= scores 1x At the time of a part / less than 10km transit of 2= scores 0x At the time of a part / 2= score stop - 1x At the time of a part / 2= score signals halt - 1.5x A part / 2= scores [0040] Since the total 50km transit time is 3 minutes, a score about the 1st path For example, 7.5 points, Since the total 40km transit time is 6.4 minutes and a score is [12.8 points and the total 30km transit time] 1.4 minutes, a score 2.1 points, Since the total 20km transit time is 4.9 minutes and a score is [4.9 points and the total 10km transit time] 5.9 minutes, a score 2.95 points, Since there are 4 minutes as -1.5 points and a signal halt show drawing 5 , since the stop by delay is 3 minutes as shown in drawing 5 , a total score turns into 25.75 points by -three points. In addition,

what thought reducing the count of a halt and time amount by the signal as important has a high subtracting point, and when making an issue of only the time of arrival, in a signal halt [stop], it cannot identify a stop and a signal halt, but can treat them equally to it. On the other hand, to aim at avoiding the stop by delay, it is necessary to enlarge a subtracting point for the stop rather than a signal halt.

[0041] Since the total 50km transit time is 9 minutes, on the other hand about the 2nd path, a score 22.5 points, Since the total 40km transit time is 1.5 minutes and a score is [three points and the total 30km transit time] 1.5 minutes, a score 2.25 points, Since the total 20km transit time is 3 minutes and a score is [three points and the total 10km transit time] 6 minutes, as a stop according [a score] to three points and delay shows drawing 6 , there is nothing, and since there are 3 minutes as a signal halt shows drawing 6 , a total score turns into 31.5 points by -2.25 points.

[0042] CPU12 determines the path in which a sum total score is the highest, as a recommendation path from the result searched for at the above-mentioned step 58 (S60). Here, the 2nd path of 46.25 points is made into a recommendation path for a sum total score. And CPU12 performs path guidance according to this determined path (S62). That is, the voice control signal (for example, "500m beyond is turned left") which outputted the map for path guidance to the monitor 28 based on the map data created with the read data, and was extracted from map data is made to output from a loudspeaker 38. Although it is more far in stroke distance, it can be made to arrive at Destination b by the shortest time amount in the 1st example here by performing navigation so that it may pass along the 2nd shorter path of a duration. Moreover, although distribution of a rate was made into every 10km in the above-mentioned example, you may subdivide with every 5km and 2km.

[0043] Next, the 2nd example of this invention is explained with reference to the flow chart of drawing 11 and drawing 12 . Although the travel speed at the time of transit and the stop time were separately recorded as data and the 1st example mentioned above estimated the path based on these, the navigation equipment of this 2nd example memorizes the rate and time amount for every joint road which constitute each path, and determines a path based on this rate or time amount.

[0044] First, with reference to drawing 11 , the collection of the data at the time of passing through a road in the navigation equipment for mount of the 2nd example is explained. In addition, the data collection at the time of a car moving at from the origin a shown in drawing 2 to the destination b is explained here. This car passes through a crossing B-1 from Origin a, turns a crossing A-1 to the right, passes a crossing A-2, A-3, A-4, and A-5 the back, and explains as what turns a crossing A-6 left and arrives at Destination b.

[0045] CPU12 checks current time first (S112). Here, since current time is 9:30 a.m., subsequent measured value is held as data at 9:00 a.m. Next, CPU12 recognizes the joint road under current transit based on the current position and a travelling direction. Here, since it is running joint road a-B -1 of the Origin a and the crossing B-1 which are shown in drawing 2 , a-B -1 is recognized as a joint road. and the crossing B-1 after leaving Origin a -- arrival -- or elapsed time until it passes is memorized (S116). That is, elapsed time after coming out of Origin a until it arrives at a crossing B-1 is memorized.

[0046] And CPU12 memorizes the mean velocity which computed mean velocity (S118) and computed by breaking by the above-mentioned elapsed time the distance from the origin a included in map data to a crossing B-1 (S120). Then, the average value in 10 latest times is similarly computed with having mentioned above with reference to drawing 9 , and it holds as joint road data (S122). By repeating processing of the above-mentioned step 112 to the step 122 until it arrives at Destination b, the joint road data about each joint road to Destination b are collected.

[0047] Then, it explains with reference to the flow chart, drawing 1 , and drawing 2 which show actuation of a destination setup of the navigation equipment for mount concerning the 2nd example to

drawing 12 . First, CPU12 will detect the current position (origin), if the destination is inputted through an input unit 20 (S142 is Yes) (S144).
[0048] Then, CPU12 retrieves map information (S146). That is, while accessing CDROM and obtaining map data including the inputted destination and the current position, the road which connects the crossing and this crossing which are included in these map data is acquired by searching joint road data. Here, the path network containing a crossing group while connecting from the origin a as shown in drawing 2 based on the joint road data contained in this CDROM to the destination b is searched.
[0049] And CPU12 lists two or more paths through which it can pass from the path network to which the crossing shown in drawing 2 is connected (S148). That is, the path (the 1st path) of point a, crossing A-1, A-6, and point b and the path (the 2nd path) of point a, crossing B-1, B-6, and point b are chosen like the 1st example as a path through which it can pass.
[0050] Next, CPU12 searches with step 150 the joint road data collected during the transit mentioned above about the joint road which constitutes the 1st path and the 2nd path by which selection was made [above-mentioned]. Here, since the ETD is 9:15 a.m., the data of 9:00 shall be searched about the 1st path and the 2nd path in the morning.
[0051] CPU12 computes required time amount, after leaving Origin a about each of the 1st path and the 2nd path succeedingly based on the searched data before arriving at Destination b (S152). Here, the 2nd path should be computed for the 1st path as 30 minutes for 35 minutes. Then, based on the total mileage and the duration which were searched, ********** to Destination b is computed from Origin a about the 1st path and the 2nd path (S154). Here, a part for 15 km/hr and the 2nd path should be computed for the 1st path as 17 km/hr. And CPU12 chooses a path with the shorter need time amount found at step 152, or the path in which the mean velocity for which it asked at step 154 is high (S160). Then, CPU12 performs path guidance according to this determined path (S162).
[0052] The navigation equipment of the 1st and 2nd example becomes possible [choosing the path which may arrive at the destination by the shortest time amount], in order to collect data per joint road about the actually passed path and to determine a path based on this data.
[0053] Moreover, with the navigation equipment of the 1st example, since the live data of the transit time are reflected in path planning, the property by the time zone of the road is not overlooked. That is, since the transit pattern approximated to actual transit can be predicted, the shortest path can be chosen more exactly and the count of a halt of a car can be lessened. For this reason, low-fuel-consumption transit is attained and exhaust gas can be reduced.
[0054] The process of path decision is displayed on an operator, and although navigation was performed about the path it was decided that CPU12 would be, it can constitute from navigation equipment of this example also so that it may make it decided that an operator will be a path. For example, drawing 3 , the anticipation path transit pattern of drawing 4 , and the velocity profile shown in drawing 7 are displayed on a monitor 28, and it can constitute also so that an operator may be made to choose the 1st path or the 2nd path. Moreover, although it was made to correspond to the ETD and joint road data were searched with the example mentioned above, it is also possible to make it instead correspond at the passage schedule time of day of each joint road, and to search a joint road.
[0055]
[Effect] Since the highest path of mean velocity is chosen in the navigation equipment for claim 1 mount as described above, the path it can run at the highest rate can be chosen.
[0056] With the path planning equipment for mount of claim 2, since the shortest path of a duration is chosen, the path which can arrive at the destination by the shortest time amount can be chosen.
[0057] Moreover, since the path planning equipment for mount of claim 3 estimates a path based on the rate change in each joint road which constitutes a path, a signal stop time, and stop time amount,

the optimal path can be elected.
[0058] Since the short path of a signal stop time is furthermore chosen with the path planning equipment for mount of claim 4 while the transit time in a high rate is long and the stop time with which a signal stop time and stop time amount were doubled is short, a travel speed is high and the short path of the stop time in a signal can be chosen.
[0059] With the path planning equipment for mount of claim 5, the measured data are memorized per time of day, and since it is made to correspond to departure time and a path is chosen, the most suitable path can be chosen according to a passing predetermined time.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] This invention relates to the path planning equipment for mount which searches for and guides the path to the destination from a its present location using the map information recorded on the record medium.

[Translation done.]

PRIOR ART

[Description of the Prior Art] As the path planning approach in conventional navigation equipment, the shortest thing of the stroke distance of a path was chosen as a recommendation path. However, there is much traffic, and since the frequency of a signal halt by the method of selection of a path may increase or decrease in case the path in which crossing passage frequency is high is passed, in order to arrive at the destination for a short time, it is necessary to choose a path with few signal halt in a crossing than the path in which stroke distance is short. Then, JP,5-128339,A is proposed as an approach of decreasing the signal stop time in a crossing. The road-side communication receiver which receives the location of a signal and color change from a road-side beacon is carried in a car, the speed range where a signal stop time serves as min is computed, and transit is controlled by this approach so that a travel speed becomes within the limits of it.

[Translation done.]

EFFECT OF THE INVENTION

[Effect] Since the highest path of mean velocity is chosen in the navigation equipment for claim 1 mount as described above, the path it can run at the highest rate can be chosen.
[0056] With the path planning equipment for mount of claim 2, since the shortest path of a duration is chosen, the path which can arrive at the destination by the shortest time amount can be chosen.
[0057] Moreover, since the path planning equipment for mount of claim 3 estimates a path based on the rate change in each joint road which constitutes a path, a signal stop time, and stop time amount, the optimal path can be elected.
[0058] Since the short path of a signal stop time is furthermore chosen with the path planning equipment for mount of claim 4 while the transit time in a high rate is long and the stop time with which a signal stop time and stop time amount were doubled is short, a travel speed is high and the short path of the stop time in a signal can be chosen.
[0059] With the path planning equipment for mount of claim 5, the measured data are memorized per time of day, and since it is made to correspond to departure time and a path is chosen, the most suitable path can be chosen according to a passing predetermined time.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In trunk roads, such as an actual road, especially a national highway, however, the commuting time band of every morning and evening, Or even if it calculates speed range so that delay may occur in a time zone with much traffic of day ranges in many cases and the signal of the crossing on a course may pass in a blue lighting time zone like the above-mentioned official report It was impossible to have run in the speed range by the path or the time zone it runs in many cases, and it was not practical by the road with much traffic.
[0004] The place which it is made in order that this invention may solve the technical problem mentioned above, and is made into the purpose is to offer the path planning equipment for mount which can search for the path which arrives at the destination by the shortest time amount.

[Translation done.]

MEANS

[Means for Solving the Problem] In order to attain the above-mentioned purpose, with the path planning equipment for mount of claim 1 of this invention It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A rate change storage means to memorize change of ** which passes through one joint road of a travel speed, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, A mean velocity operation means to calculate based on the rate change in each joint road which constitutes the path concerned currently held at said rate change storage means about the mean velocity of two or more paths for which it was searched by said path planning means, Let it be a summary to have had a routing means to choose the highest path of mean velocity, in two or more paths for which it was searched by said path planning means based on the result of an operation by said mean velocity operation means.
[0006] With the path planning equipment for mount of claim 2, moreover, the storage section of map information, a current position detection means, And a road-system map storage means by which are path planning equipment for mount which searches for the path from the current position to the destination including a destination input means, and the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A time amount storage means to memorize the time amount which passage took whenever it passes through one joint road, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, A duration operation means to calculate based on the pass time of each joint road which constitutes the path concerned currently held at said time amount storage means about the duration of two or more paths for which it was searched by said path planning means, Let it be a summary to have had a routing means to choose the shortest path of a duration, in two or more paths for which it was searched by said path planning means based on the result of an operation by said duration operation means.
[0007] In order to attain the above-mentioned purpose, moreover, with the path planning equipment for mount of claim 3 of this invention It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A rate change storage means to memorize change of a travel speed whenever it passes through one joint road, A signal stop-time storage means to memorize the time amount which carried out a signal halt at the crossing, A stop time amount storage means to memorize the time amount stopped by the joint road, A path planning means to search for two or more paths

short in distance from the current position to the destination based on the map information memorized by said storage section, The rate change in each joint road which constitutes the path concerned currently held at said rate change storage means about two or more paths for which it was searched by said path planning means, The signal stop time in each joint road which constitutes the path concerned currently held at said signal stop-time storage means, A path evaluation means to evaluate based on the stop time amount in each joint road which constitutes the path concerned currently held at said stop time amount storage means, Let it be a summary to have had a routing means to choose the path in which evaluation is the highest, in two or more paths for which it was searched by said path planning means based on the evaluation result by said path evaluation means.

[0008] Moreover, with the path planning equipment for mount of claim 4, in claim 3, said path evaluation means makes it a summary to esteem the short path of a signal stop time, while the transit time in a high rate is long and the stop time with which a signal stop time and stop time amount were doubled is short.

[0009] Moreover, with the path planning equipment for mount of claim 5, it sets to claim 3 or 4. Said rate change storage means, said signal stop-time storage means, and said stop time amount storage means memorize data in the time-of-day unit set up beforehand. Said path evaluation means The passage time of day of a path Or let it be a summary to make it correspond to departure time and to evaluate a path based on the data of the time-of-day unit of said rate change storage means, said signal stop-time storage means, and said stop time amount storage means.

[Translation done.]

OPERATION

[Function] With the path planning equipment for mount of claim 1, whenever it passes through one joint road, change of a travel speed is memorized for the rate change storage means. That is, the information about the road through which it passed is held. And in case the path from the current position to the destination is chosen, in two or more paths for which it was searched by the path planning means, the mean velocity of each path is calculated based on the data of change of the travel speed in each joint road where a mean velocity operation means constitutes the path concerned held at the rate change storage means. Then, a routing means chooses the highest path of mean velocity. For this reason, the path it can run at the highest rate is chosen.
[0011] With the path planning equipment for mount of claim 2, whenever it passes through one joint road, the time amount which passage took is memorized for the time amount storage means. That is, the information about the road through which it passed is held. And in case the path from the current position to the destination is chosen, in two or more paths for which it was searched by the path planning means, the duration of each path is calculated based on the data of the time amount in each joint road where a duration operation means constitutes the path concerned held at the time amount storage means. Then, a routing means chooses the shortest path of a duration. For this reason, the path which can arrive at the destination by the shortest time amount is chosen.
[0012] With the path planning equipment for mount of claim 3, whenever it passes through one joint road, a rate change storage means memorizes change of a travel speed, the time amount in which the signal stop-time storage means carried out a signal halt at the crossing is memorized, and the time amount which the stop time amount storage means stopped by the joint road is memorized. That is, the information about the road through which it passed is held. Rate change in each joint road where a path evaluation means constitutes the path concerned currently held at the rate change storage means about two or more paths for which it was searched by the path planning means in case the path from the current position to the destination is chosen, It evaluates based on the signal stop time in each joint road which constitutes the path concerned currently held at the signal stop-time storage means, and the stop time amount in each joint road which constitutes the path concerned currently held at the stop time amount storage means. And a routing means chooses the path in which evaluation is the highest, in two or more paths based on the evaluation result by the path evaluation means. For this reason, the most suitable path can be elected.
[0013] A path evaluation means esteems the short path of a signal stop time by the path planning equipment for mount of claim 4, while the transit time in a high rate is long and the stop time with which a signal stop time and stop time amount were doubled is short. For this reason, a travel speed is high and can choose the short path of the stop time in a signal.
[0014] A rate change storage means, a signal stop-time storage means, and a stop time-amount storage means memorize data in the time-of-day unit set up beforehand, and a path evaluation means makes it correspond to the passage time of day or the departure time of a path, and evaluates a path by the

path-planning equipment of claim 5 for mount based on the data of the time-of-day unit of a rate change storage means, a signal stop-time storage means, and said stop time-amount storage means. Although the flow of the vehicle on a path changes with time of day, it can choose the most suitable path with the path planning equipment for mount of claim 5 according to passing time amount.

[Translation done.]

EXAMPLE

[Example] Hereafter, the example which materialized this invention is explained with reference to drawing. Drawing 1 is the block diagram showing the configuration of the navigation equipment for mount concerning one example of this invention. In this example, GPS receiver 18 is used as a measuring device of a self-vehicle location.
[0016] GPS receiver 18 computes a self-vehicle location by restoring to them and carrying out data processing of the data from the electric wave received by exclusive antenna 18a attached in the car. The computed self-vehicle location data are sent to CPU12. In addition, CPU12 adds amendment to positional information from GPS receiver 18 with the output from the gyroscope which is not illustrated and a speed sensor.
[0017] The joint road data which consist of the distance of the road which connects the crossing on this map, its position coordinate, and crossing other than the map data which carried out data processing of the map at the predetermined format, and this connection road are contained in CDROM (not shown) with which the CDROM player 30 is loaded. The CDROM player 30 reproduces this CDROM, reads desired map data and joint road data, and sends them to CPU12.
[0018] CPU12 makes required data read to the CDROM player 30. The map screen data created with the data read by this are written in VRAM24 through the graphic display controller (GDC) 22. GDC22 outputs the signal which reads the screen data which generate a display timing signal, and output to a monitor 28, and are memorized by VRAM24 while making VRAM24 memorize screen data. The output of the data read from VRAM24 is changed into the analog RGB signal by the pallet DAC 26, and is displayed as an image with a monitor 28.
[0019] CPU12 gives the control signal (for example, control signal changed into the sound signal "500m beyond is turned left") which combined with the image display by the monitor mentioned above, and was extracted from the above-mentioned map data to an audio output device 36. This audio output device 36 changes a control signal into a sound signal, and is made to output it from a loudspeaker 38.
[0020] ROM14 is the memory work habits (program) and fixed data of CPU12 were remembered to be. Moreover, RAM16 is working-level month memory used if needed, in case CPU12 advances various kinds of processings. An input unit 20 is equipped with the input key for carrying out a destination input, when a user presses an input key with a finger, is equipment which performs a setup and actuation of the destination of the navigation equipment for mount, and sends out the signal according to actuation to CPU12. Moreover, a receiver 32 receives information, such as delay and road repairing, and sends it out to CPU12.
[0021] Next, actuation of a destination setup of the navigation equipment for mount concerning the 1st example is explained with reference to drawing 2 thru/or drawing 12 . In case collection maintenance of the data about the road is carried out in case it passes through a road, and a path is

searched with the navigation equipment for mount of the 1st example next time, a transit pattern is predicted based on the data of the road through which it actually passed, and a path is determined. Here, first, about the data collection at the time of passing through a road, the data collection at the time of a car moving with reference to the flow chart of drawing 8 at from the origin a shown in drawing 2 to the destination b is mentioned as an example, and is explained. This car passes through a crossing B-1 from Origin a, turns a crossing A-1 to the right, passes a crossing A-2, A-3, A-4, and A-5 the back, and explains as what turns a crossing A-6 left and arrives at Destination b. In this case, the contents of the data collected are expressed to drawing 5 , and a rate pattern while passing the above-mentioned path is expressed to drawing 3 .

[0022] CPU12 checks current time first (S12). That is, it is for matching collection of data with time of day, and performing it. here -- a start of Origin a -- since time of day is 9:30 a.m. (refer to drawing 3), subsequent measured value is held as data at 9:00 a.m. Next, CPU12 recognizes the joint road under current transit based on the current position and a travelling direction. Here, since the car is running joint road a-B -1 during Origin a and the crossing B-1 which are shown in drawing 2 , it recognizes that a joint road is a-B -1. This joint road a-B -1 also shows the transit direction besides the classification of a joint road. That is, in going to a crossing B-1 from Origin a, it becomes joint road a-B -1, and it is set to joint road B-1-a in going to Point a from a crossing B-1 on the contrary.

[0023] Next, CPU12 memorizes a transit pattern. First, it judges whether it is [be / it] under transit (S16), and since it is under transit (S16 is Yes), it holds to RAM16 (refer to drawing 1) here as transit pattern data (km/hrxmin) S1 which show a travel speed and time amount to drawing 3 (S22). Next, it judges whether the data for a joint road for one were collected (S26), when the data for 1 joint road are not being collected, it judges whether (S26 shifted to No) and step 28 and arrived at the destination, but since it has not arrived at the destination (S28 is No), collection of return and data is continued to step 12 here.

[0024] Here, if it passes through a crossing B-1 at time of day 9:32, without stopping with a signal, record of the transit pattern data S2 about the joint road B-1-A-1 which go to a crossing A-1 from a crossing B-1 will be started (S22). Here, since the data for 1 joint road about joint road a-B -1 were collected (S26 is Yes), it computes so that the average of the data about this joint road may be mentioned later (S27). And although it judges whether it arrived at the destination (S28), since it has not arrived at the destination (S28 is No), collection of return data is continued to step 12 here.

[0025] Then, if it turns left, without stopping a crossing A-1 to a signal to time of day 9:35, record of the transit pattern data S3 about the joint road A-1-2 which go from a crossing A-1 at a crossing A-2 will be started (S22). And if it passes without stopping a crossing A-2 by signal at time of day 9:38 next, record of transit pattern data S4 about the joint road A-2-3 which goes from a crossing A-2 at a crossing A-3 will be started (S22).

[0026] During transit of this joint road A-2-3 (transit pattern data S4), the stop should occur by delay from time-of-day 9:40 to time-of-day 9:43. In this case, that decision serves as No during the transit in step 16 which shows CPU12 to drawing 8 , and the current position judges whether it is before intersectional (S18). Here, since it is not a halt before intersectional but the stop which is distant from a crossing, this step 18 serves as No and it memorizes as stop time amount in the joint road A-2-3 (S20). And if it passes through delay at time of day 9:43, again, step 16 will serve as Yes and will continue record of transit pattern data S4 (S22).

[0027] Then, at the crossing A-4 (joint road A-4-5), it should stop by signal halt from time-of-day 9:48 to time-of-day 9:50. In this case, that decision serves as No during the transit in step 16 which shows CPU12 to drawing 8 , and the current position judges whether it is before intersectional (S18). Here, since it is a halt before intersectional, this step 18 serves as Yes and it memorizes as a signal

stop time in the joint road A-4-5 (S24). And if a signal becomes blue and it passes through this crossing A-4 at time of day 9:50, step 16 will serve as Yes and will start record of the transit pattern data S6 (S22).

[0028] And when it arrives at Point b and an operator extracts an ignition key, CPU12 is judged to be destination arrival (S28 is Yes), and collection processing of data ends it. In addition, although the data value exceeding 50km in legal rate set up into the path is memorized as 50km in the 1st example mentioned above, it is also possible to instead hold the rate beyond authorization by law as it is.

[0029] Here, the average-value calculation processing in step 28 mentioned above is explained with reference to drawing 9 which shows the subroutine of the step 28 concerned. Here, averaging processing of the data about above-mentioned joint road a-B -1 is mentioned as an example, and is explained. First, CPU12 calls the average of the past of this joint road a-B -1 (S30), and judges whether this measured value has 50% or more of deflection to the average (S32). Here, when there is 50% or more of deflection, (S32 abandon Yes) and the data collected this time, and end the averaging processing concerned. On the other hand, when 50% or more of deflection cannot be found, (S32 compute an average value from the measured value of No), for example, past 10 batch, and hold as joint road data which mention this value later (S34). That is, the average is updated and it enables it to correspond to change of traffic by eliminating data old 10 times or more, and calculating the average from 10 times of the latest values. Moreover, besides asking from 10 times of the latest values simply as an approach of calculating an average value, if the average value of 10 times of the latest values is separately calculated from the data in a weekday, or the data in a holiday (Saturdays-and-Sundays public holiday), it will become still more proper data to operation of a weekday or a holiday. In addition, it not only makes into a joint road the road which connects a crossing and a crossing, but in this 1st example, it processes more than the count of predetermined as a joint road of a before [a nearby crossing] from an origin, the destination, the firm where it considered as the object of navigation as a junction point, a school, a house, etc.

[0030] Next, it explains with reference to the flow chart and drawing 1 thru/or drawing 7 which shows the actuation of a destination setup of the navigation equipment for mount concerning the 1st example based on the data collected by processing mentioned above to drawing 10 . First, CPU12 will detect the current position (origin) based on the signal from GPS receiver 18, if the destination is inputted through an input unit 20 (S42 shown in drawing 10 is Yes) (S44).

[0031] Then, CPU12 retrieves map information (S46). That is, while accessing CDROM and obtaining map data including the inputted destination and the current position, the road which connects the crossing and this crossing which are included in these map data is acquired from the crossing still nearer to the destination, and the crossing nearest to the current position by searching joint road data. Here, the path network containing a crossing group while connecting from the origin a as shown in drawing 2 based on the joint road data contained in this CDROM to the destination b is searched.

[0032] And CPU12 lists two or more paths through which it can pass from the path network to which the crossing shown in drawing 2 is connected (S48). That is, the crossing group which connects from the crossing B-1 nearest to Origin a to the crossing A-6 nearest to Destination b is chosen, and the distance which connects each crossing in this crossing group is found by integrating the distance during a crossing in the above-mentioned joint road data. Here, the path in which distance is long is chosen from the path in which distance is the shortest, and this shortest path, in the range to 5%. Here, the path (the 1st path is called below) of point a, crossing A-1, A-6, and point b should be chosen as a path in which distance is the shortest. Moreover, the path (the 2nd path is called below) of point a, crossing B-1, B-6, and point b should be chosen as a path in which distance is long, in the range to 5%, for example. in addition, the predetermined range from the shortest path -- it is also possible to

choose the path in the distance which found the slant range from an origin to the destination, and applied 10% of this slant range to the distance in the shortest path instead of choosing the path of a long distance.

[0033] Next, CPU12 searches with step 50 the joint road data which are data collected during the transit mentioned above about each of the 1st path by which selection was made [above-mentioned], and the 2nd path. Here, since the ETD is 9:15 a.m., the data of 9:00 shall be searched in the morning. first, about the 1st path (path of point a, crossing A-1, A-6, and point b) Joint road a-B -1 from Point a to a crossing B-1, the joint road B-1-A-1 from a crossing B-1 to a crossing A-1, the joint road A-1-2 from a crossing A-1 to a crossing A-2, the joint road A-2-3 from a crossing A-2 to a crossing A-3, The joint road data about joint road A-6-b from the joint road A-3-4 from a crossing A-3 to a crossing A-4, the joint road A-4-5 from a crossing A-4 to a crossing A-5, the joint road A-5-6 from a crossing A-5 to a crossing A-6, and a crossing A-6 to Point b (destination) (The average value of the past 10 times of the measured value mentioned above) is searched, and an anticipation velocity profile as shown in drawing 3 based on this data is created (S52). In addition, in the explanation mentioned above, although drawing 3 was referred to as measurement data, it explains as an anticipation velocity profile based on measurement data for convenience here.

[0034] In addition, although the case where the path in the case of collection of data and the path in the case of routing are in agreement is mentioned as the example in the explanation mentioned above Since collection maintenance of the joint road data is carried out per joint road in this 1st example, having not gone to Destination b in the past directly from a metaphor and Origin a -- ** -- if the joint road data about each joint road from Origin a to Destination b are prepared, be careful of the point which can create the anticipation velocity profile mentioned above.

[0035] Succeedingly CPU12 about the 2nd path (path of point a, crossing B-1, B-6, and point b) Joint road a-B -1 from Point a to a crossing B-1, the joint road B-1-2 from a crossing B-1 to a crossing B-2, the joint road B-2-3 from a crossing B-2 to a crossing B-3, the joint road B-3-4 from a crossing B-3 to a crossing B-4, On the joint road B-4-5 from a crossing B-4 to a crossing B-5, the joint road B-5-6 from a crossing B-5 to a crossing B-6, and the joint road B-6-A-6 from a crossing B-6 to a crossing A-6 The joint road data about joint road A-6-b from a crossing A-6 to Point b are searched, and an anticipation velocity profile as shown in drawing 4 based on this data is created (S52).

[0036] Next, CPU12 computes the total with a rate [each] (0km, 10km, 20km, 30km, 40km, and 50km) transit time about the 1st path and the 2nd path (S54). for example, 50km cutting Rhine from the die length (here, equivalent to d1-e1 in drawing) which has passed the rate pattern based on the anticipation velocity profile of the 1st path shown in drawing 3 From the die length (here, equivalent to the sum total of c1-d2 in drawing, e2-f1, and g1-h1) to which the total transit time (3 minutes) with a mean velocity of 50km was computed, and 40km cutting Rhine has passed the rate pattern From the die length (here, equivalent to the sum total of i1-c2 in drawing, f2-j1, k1-g2, and h2-l1) to which the total transit time (6 minutes and 24 seconds) with a mean velocity of 40km was computed, and 30km cutting Rhine has passed the rate pattern The total transit time (24 seconds per minute) with a mean velocity of 30km is computed. Similarly, the total transit time (the mean velocity of 20km, 10km, and 0km) is computed. In addition, about the mean velocity of 0km, the both sides of stop times, such as the transit time with a rate of less than 10km and a stop, and a signal halt, are included. The sum total of the total transit time in each mean velocity becomes the elapsed time from Point a to Point b, and 35 minutes.

[0037] And CPU12 creates the velocity profile shown in drawing 7 about each of the 1st path and the 2nd path based on the transit time in each rate found at step 54 (S56). Here, drawing 7 (A) shows the velocity profile of the 1st path, and drawing 7 (B) shows the velocity profile of the 2nd path. Moreover, the duration in the 1st path and the 2nd path is found by totaling the time amount in each

rate which constitutes this velocity profile. The 1st path is 35 minutes here and the 2nd path can be found as 30 minutes.
[0038] CPU12 asks for the score of the 1st path and the 2nd path (S58). That is, in the 1st example, the transit time in a high rate is long, and a duration is not only short, but while the stop time with which a signal stop time and stop time amount were doubled is short, it chooses the short path of a signal stop time. For this reason, in quest of a score, it considers as the object of evaluation about each path. Here, it asks for a score based on the formula 1 currently held at ROM14 (refer to drawing 2). In addition, although the 10km transit time is also included in the sum total of the total transit time, in this example, the score of this transit time is computed as zero point.
[0039]
[Equation 1] the time of 50km transit 5x a part -- /2= score 40km transit -- the time -- 4x At the time of a part / 30km transit of 2= scores 3x At the time of part / 20km transit of 2= scores 2x At the time of a part / 10km transit of 2= scores 1x At the time of a part / less than 10km transit of 2= scores 0x At the time of a part / 2= score stop - 1x At the time of a part / 2= score signals halt - 1.5x A part / 2= scores [0040] Since the total 50km transit time is 3 minutes, a score about the 1st path For example, 7.5 points, Since the total 40km transit time is 6.4 minutes and a score is [12.8 points and the total 30km transit time] 1.4 minutes, a score 2.1 points, Since the total 20km transit time is 4.9 minutes and a score is [4.9 points and the total 10km transit time] 5.9 minutes, a score 2.95 points, Since there are 4 minutes as -1.5 points and a signal halt show drawing 5 , since the stop by delay is 3 minutes as shown in drawing 5 , a total score turns into 25.75 points by -three points. In addition, what thought reducing the count of a halt and time amount by the signal as important has a high subtracting point, and when making an issue of only the time of arrival, in a signal halt [stop], it cannot identify a stop and a signal halt, but can treat them equally to it. On the other hand, to aim at avoiding the stop by delay, it is necessary to enlarge a subtracting point for the stop rather than a signal halt.
[0041] Since the total 50km transit time is 9 minutes, on the other hand about the 2nd path, a score 22.5 points, Since the total 40km transit time is 1.5 minutes and a score is [three points and the total 30km transit time] 1.5 minutes, a score 2.25 points, Since the total 20km transit time is 3 minutes and a score is [three points and the total 10km transit time] 6 minutes, as a stop according [a score] to three points and delay shows drawing 6 , there is nothing, and since there are 3 minutes as a signal halt shows drawing 6 , a total score turns into 31.5 points by -2.25 points.
[0042] CPU12 determines the path in which a sum total score is the highest, as a recommendation path from the result searched for at the above-mentioned step 58 (S60). Here, the 2nd path of 46.25 points is made into a recommendation path for a sum total score. And CPU12 performs path guidance according to this determined path (S62). That is, the voice control signal (for example, "500m beyond is turned left") which outputted the map for path guidance to the monitor 28 based on the map data created with the read data, and was extracted from map data is made to output from a loudspeaker 38. Although it is more far in stroke distance, it can be made to arrive at Destination b by the shortest time amount in the 1st example here by performing navigation so that it may pass along the 2nd shorter path of a duration. Moreover, although distribution of a rate was made into every 10km in the above-mentioned example, you may subdivide with every 5km and 2km.
[0043] Next, the 2nd example of this invention is explained with reference to the flow chart of drawing 11 and drawing 12 . Although the travel speed at the time of transit and the stop time were separately recorded as data and the 1st example mentioned above estimated the path based on these, the navigation equipment of this 2nd example memorizes the rate and time amount for every joint road which constitute each path, and determines a path based on this rate or time amount.
[0044] First, with reference to drawing 11 , the collection of the data at the time of passing through a

road in the navigation equipment for mount of the 2nd example is explained. In addition, the data collection at the time of a car moving at from the origin a shown in drawing 2 to the destination b is explained here. This car passes through a crossing B-1 from Origin a, turns a crossing A-1 to the right, passes a crossing A-2, A-3, A-4, and A-5 the back, and explains as what turns a crossing A-6 left and arrives at Destination b.
[0045] CPU12 checks current time first (S112). Here, since current time is 9:30 a.m., subsequent measured value is held as data at 9:00 a.m. Next, CPU12 recognizes the joint road under current transit based on the current position and a travelling direction. Here, since it is running joint road a-B -1 of the Origin a and the crossing B-1 which are shown in drawing 2 , a-B -1 is recognized as a joint road. and the crossing B-1 after leaving Origin a -- arrival -- or elapsed time until it passes is memorized (S116). That is, elapsed time after coming out of Origin a until it arrives at a crossing B-1 is memorized.
[0046] And CPU12 memorizes the mean velocity which computed mean velocity (S118) and computed by breaking by the above-mentioned elapsed time the distance from the origin a included in map data to a crossing B-1 (S120). Then, the average value in 10 latest times is similarly computed with having mentioned above with reference to drawing 9 , and it holds as joint road data (S122). By repeating processing of the above-mentioned step 112 to the step 122 until it arrives at Destination b, the joint road data about each joint road to Destination b are collected.
[0047] Then, it explains with reference to the flow chart, drawing 1 , and drawing 2 which show actuation of a destination setup of the navigation equipment for mount concerning the 2nd example to drawing 12 . First, CPU12 will detect the current position (origin), if the destination is inputted through an input unit 20 (S142 is Yes) (S144).
[0048] Then, CPU12 retrieves map information (S146). That is, while accessing CDROM and obtaining map data including the inputted destination and the current position, the road which connects the crossing and this crossing which are included in these map data is acquired by searching joint road data. Here, the path network containing a crossing group while connecting from the origin a as shown in drawing 2 based on the joint road data contained in this CDROM to the destination b is searched.
[0049] And CPU12 lists two or more paths through which it can pass from the path network to which the crossing shown in drawing 2 is connected (S148). That is, the path (the 1st path) of point a, crossing A-1, A-6, and point b and the path (the 2nd path) of point a, crossing B-1, B-6, and point b are chosen like the 1st example as a path through which it can pass.
[0050] Next, CPU12 searches with step 150 the joint road data collected during the transit mentioned above about the joint road which constitutes the 1st path and the 2nd path by which selection was made [above-mentioned]. Here, since the ETD is 9:15 a.m., the data of 9:00 shall be searched about the 1st path and the 2nd path in the morning.
[0051] CPU12 computes required time amount, after leaving Origin a about each of the 1st path and the 2nd path succeedingly based on the searched data before arriving at Destination b (S152). Here, the 2nd path should be computed for the 1st path as 30 minutes for 35 minutes. Then, based on the total mileage and the duration which were searched, ********** to Destination b is computed from Origin a about the 1st path and the 2nd path (S154). Here, a part for 15 km/hr and the 2nd path should be computed for the 1st path as 17 km/hr. And CPU12 chooses a path with the shorter need time amount found at step 152, or the path in which the mean velocity for which it asked at step 154 is high (S160). Then, CPU12 performs path guidance according to this determined path (S162).
[0052] The navigation equipment of the 1st and 2nd example becomes possible [choosing the path which may arrive at the destination by the shortest time amount], in order to collect data per joint road about the actually passed path and to determine a path based on this data.

[0053] Moreover, with the navigation equipment of the 1st example, since the live data of the transit time are reflected in path planning, the property by the time zone of the road is not overlooked. That is, since the transit pattern approximated to actual transit can be predicted, the shortest path can be chosen more exactly and the count of a halt of a car can be lessened. For this reason, low-fuel-consumption transit is attained and exhaust gas can be reduced.
[0054] The process of path decision is displayed on an operator, and although navigation was performed about the path it was decided that CPU12 would be, it can constitute from navigation equipment of this example also so that it may make it decided that an operator will be a path. For example, drawing 3 , the anticipation path transit pattern of drawing 4 , and the velocity profile shown in drawing 7 are displayed on a monitor 28, and it can constitute also so that an operator may be made to choose the 1st path or the 2nd path. Moreover, although it was made to correspond to the ETD and joint road data were searched with the example mentioned above, it is also possible to make it instead correspond at the passage schedule time of day of each joint road, and to search a joint road.

[Translation done.]

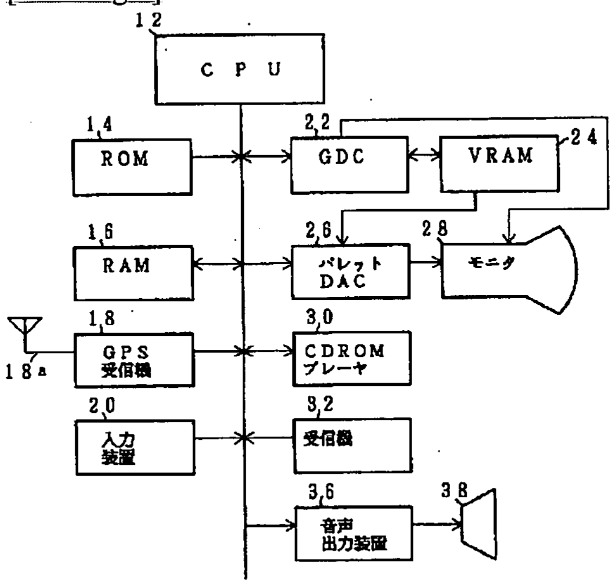
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the block diagram showing the electric configuration of the navigation equipment for mount concerning one example of this invention.
[Drawing 2] It is the explanatory view showing the path chosen by the navigation equipment concerning the 1st example.
[Drawing 3] It is the explanatory view showing the anticipation path transit pattern of the 1st path.
[Drawing 4] It is the explanatory view showing the anticipation path transit pattern of the 2nd path.
[Drawing 5] It is the explanatory view showing the contents of the joint road data of the 1st path.
[Drawing 6] It is the explanatory view showing the contents of the joint road data of the 2nd path.
[Drawing 7] Drawing 7 (A) is an explanatory view which ** the velocity profile of the 1st path, and drawing 7 (B) is an explanatory view which ** the velocity profile of the 2nd path.
[Drawing 8] It is the flow chart which shows processing for collection of the joint road data of the navigation equipment of the 1st example.
[Drawing 9] It is the flow chart which shows the subroutine of the average-value calculation processing in the processing shown in drawing 8 .
[Drawing 10] It is the flow chart which shows path planning processing of the navigation equipment concerning the 1st example.
[Drawing 11] It is the flow chart which shows processing for collection of the joint road data of the navigation equipment of the 2nd example.
[Drawing 12] It is the flow chart which shows path planning processing of the navigation equipment concerning the 2nd example.
[Description of Notations]
12 CPU
18 GPS Receiver
28 Monitor
30 CDROM Player

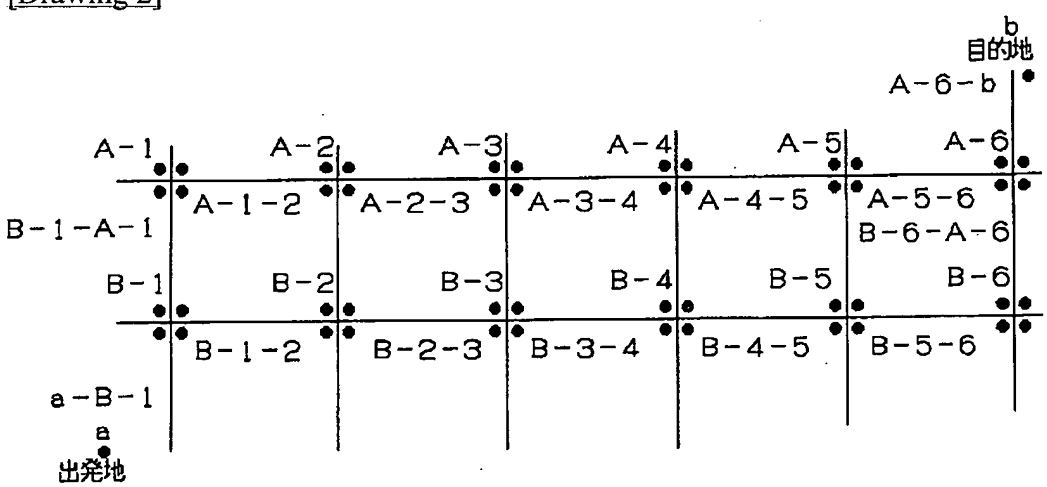
[Translation done.]

DRAWINGS

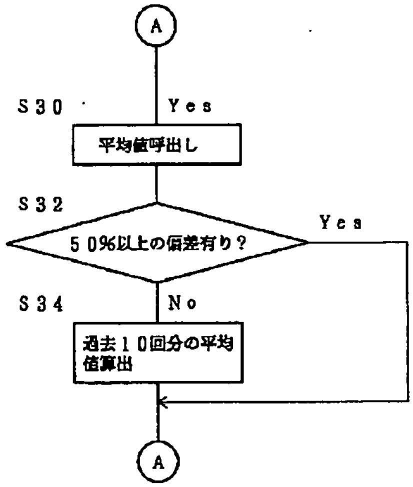
[Drawing 1]



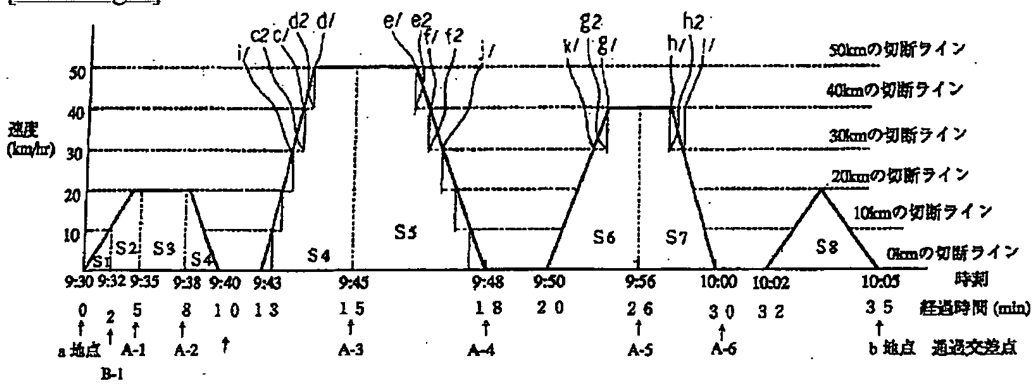
[Drawing 2]



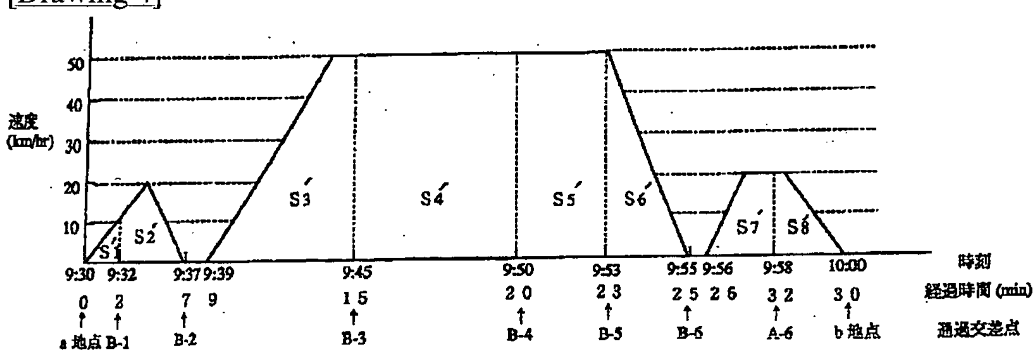
[Drawing 9]



[Drawing 3]



[Drawing 4]



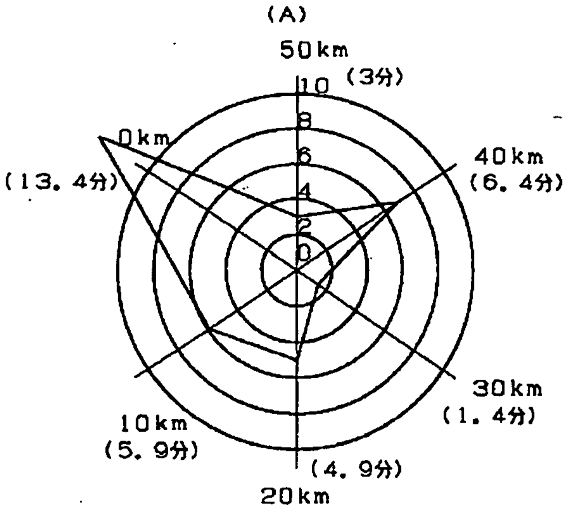
[Drawing 5]

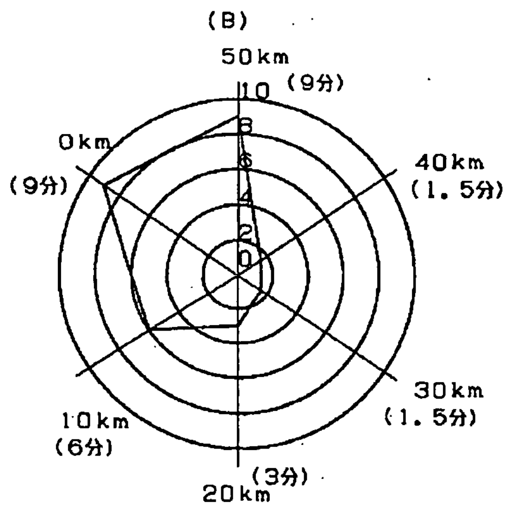
時間帯（1時間刻み）		9：00									10：00
交差点番号	地名および交差点番号	a	B-1	A-1	A-2	A-3	A-4	A-5	A-6	b	
結合道路情報	結合道路番号	a-B-1	B-1-A-1	A-1-2	A-2-3	A-3-4	A-4-5	A-5-6	A-6-b		
	走行パターン画像データ(km/hr×min)	S1	S2	S3	S4	S5	S6	S7	S8		行程所要時間(min)
	走行時間 (min)	2	3	3	4	3	6	4	3		
	一旦停止時間 (min)				3						
	信号停止時間 (min)						2		2		
	交差点間所要時間(min)	2	3	3	7	3	8	4	5		35

[Drawing 6]

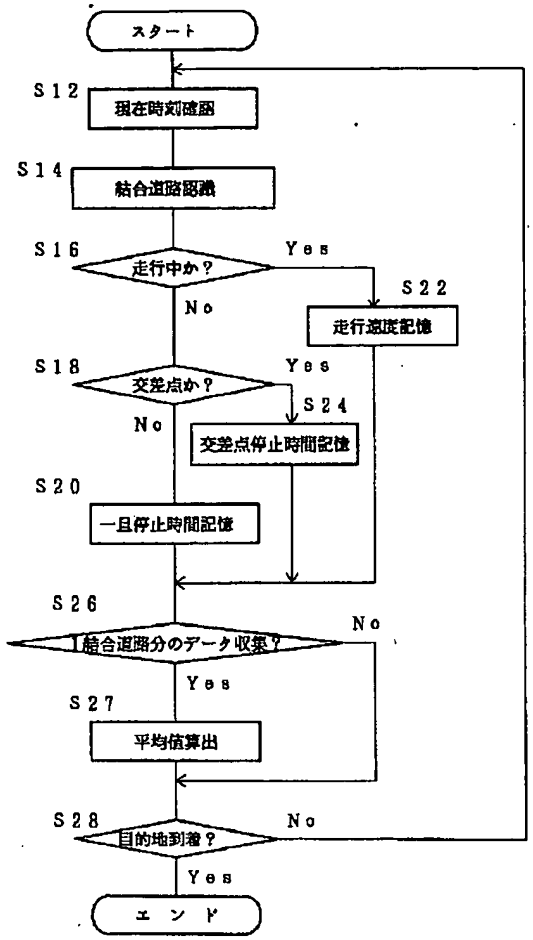
時間帯（1時間刻み）		9：00									
交差点番号	地名および交差点番号	a	B-1	B-2	B-3	B-4	B-5	B-6	A-6	b	
結合道路情報	結合道路番号	a-B-1	B-1-2	B-2-3	B-3-4	B-4-5	B-5-6	B-6-A-6	A-6-b		
	走行パターン画像データ(km/hr×min)	S1′	S2′	S3′	S4′	S5′	S6′	S7′	S8′		行程所要時間(min)
	走行時間 (min)	2	5	6	5	3	2	2	2		
	一旦停止時間 (min)										
	信号停止時間 (min)			2				1			
	交差点間所要時間(min)	2	5	8	5	3	2	3	2		30

[Drawing 7]

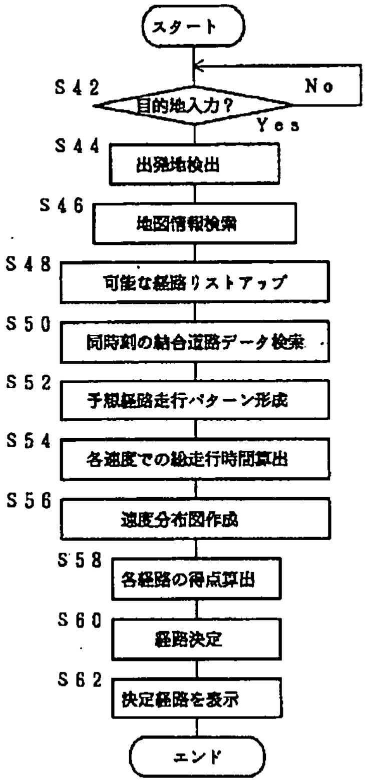

(A)
50km
(3分)
10
8
6
4
2
0
0km
(13.4分)
40km
(6.4分)
30km
(1.4分)
10km
(5.9分)
(4.9分)
20km


(B)
50km
(9分)
10
8
6
4
2
0
0km
(9分)
40km
(1.5分)
30km
(1.5分)
10km
(6分)
(3分)
20km

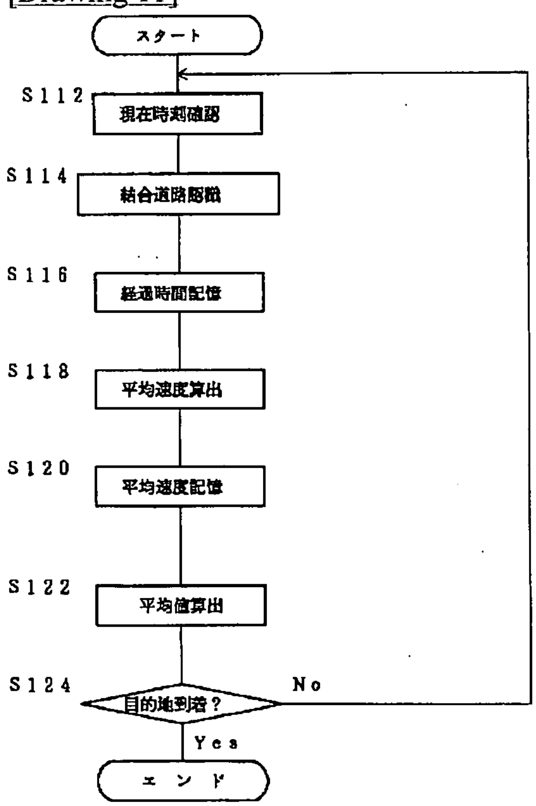
[Drawing 8]


スタート
S12
現在時刻確認
S14
結合道路認識
S16
走行中か？
Yes
No
S22
走行速度記憶
S18
交差点か？
Yes
No
S24
交差点停止時間記憶
S20
一旦停止時間記憶
S26
1結合道路分のデータ収集？
No
Yes
S27
平均値算出
S28
目的地到着？
No
Yes
エンド

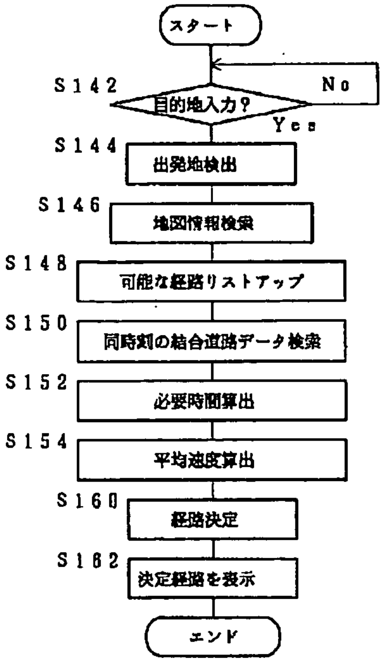
[Drawing 10]



[Drawing 11]



[Drawing 12]



[Translation done.]

CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
[Section partition] The 1st partition of the 6th section
[Publication date] August 28, Heisei 14 (2002. 8.28)

[Publication No.] JP,9-14986,A
[Date of Publication] January 17, Heisei 9 (1997. 1.17)
[Annual volume number] Open patent official report 9-150
[Application number] Japanese Patent Application No. 7-183551
[The 7th edition of International Patent Classification]

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G01C  21/00
G08G   1/09
1/0969
G09B  29/10
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[FI]

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G01C  21/00        G
G08G   1/09        S
1/0969
G09B  29/10        A
```


[Procedure revision]
[Filing Date] June 12, Heisei 14 (2002. 6.12)
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information,
A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized,
A travel-speed storage means to memorize the travel speed of ** which passes through one joint road,

A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section,
A mean velocity operation means to calculate based on the travel speed in each joint road which constitutes the path concerned currently held at said travel-speed storage means about the mean velocity of two or more paths for which it was searched by said path planning means,
Path planning equipment for mount characterized by having a routing means to choose the highest path of mean velocity, in two or more paths for which it was searched by said path planning means based on the result of an operation by said mean velocity operation means.
[Claim 2] It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information,
A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized,
A time amount storage means to memorize the time amount which passage took whenever it passes through one joint road,
A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section,
A duration operation means to calculate based on the pass time of each joint road which constitutes the path concerned currently held at said time amount storage means about the duration of two or more paths for which it was searched by said path planning means,
Path planning equipment for mount characterized by having a routing means to choose the shortest path of a duration, in two or more paths for which it was searched by said path planning means based on the result of an operation by said duration operation means.
[Claim 3] It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information,
A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized,
A travel-speed storage means to memorize a travel speed whenever it passes through one joint road, a signal stop-time storage means to memorize the time amount which carried out a signal halt at the crossing, and a stop time amount storage means to memorize the time amount stopped by the joint road,
A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section,
The path evaluation means evaluate based on the travel speed in each joint road which constitutes the path concerned currently held at said travel-speed storage means, the signal stop time in each joint road which constitutes the path concerned currently held at said signal stop-time storage means, and the stop time amount in each joint road which constitutes the path concerned currently held at said stop time-amount storage means about two or more paths for which it was searched by said path-planning means,
Path planning equipment for mount characterized by having a routing means to choose the path in which evaluation is the highest, in two or more paths for which it was searched by said path planning means based on the evaluation result by said path evaluation means.
[Claim 4] Path planning equipment for mount of claim 3 with which said path evaluation means is characterized by esteeming the short path of a signal stop time while the transit time in a high rate is long and the stop time with which a signal stop time and stop time amount were doubled is short.
[Claim 5] Said travel-speed storage means, said signal stop-time storage means, and said stop time amount storage means memorize data in the time-of-day unit set up beforehand. Said path evaluation

means The passage time of day of a path Or claim 3 or 4 path planning equipment for mount which are characterized by making it correspond to departure time and evaluating a path based on the data of the time-of-day unit of said travel-speed storage means, said signal stop-time storage means, and said stop time amount storage means.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0005
[Method of Amendment] Modification
[Proposed Amendment]
[0005]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, with the path planning equipment for mount of claim 1 of this invention It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A travel-speed storage means to memorize the travel speed of ** which passes through one joint road, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, A mean velocity operation means to calculate based on the travel speed in each joint road which constitutes the path concerned currently held at said travel-speed storage means about the mean velocity of two or more paths for which it was searched by said path planning means, Let it be a summary to have had a routing means to choose the highest path of mean velocity, in two or more paths for which it was searched by said path planning means based on the result of an operation by said mean velocity operation means.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0007
[Method of Amendment] Modification
[Proposed Amendment]
[0007] In order to attain the above-mentioned purpose, moreover, with the path planning equipment for mount of claim 3 of this invention It is path planning equipment for mount which searches for the path from the current position to the destination including the storage section, current position detection means, and destination input means of map information. A road-system map storage means by which the joint road which connects during the crossing on a map, and the position coordinate and a crossing was memorized, A travel-speed storage means to memorize a travel speed whenever it passes through one joint road, A signal stop-time storage means to memorize the time amount which carried out a signal halt at the crossing, A stop time amount storage means to memorize the time amount stopped by the joint road, A path planning means to search for two or more paths short in distance from the current position to the destination based on the map information memorized by said storage section, The travel speed in each joint road which constitutes the path concerned currently held at said travel-speed storage means about two or more paths for which it was searched by said path planning means, The signal stop time in each joint road which constitutes the path concerned currently held at said signal stop-time storage means, A path evaluation means to evaluate based on the stop time amount in each joint road which constitutes the path concerned currently held at said stop time amount storage means, Let it be a summary to have had a routing means to choose the path in which evaluation is the highest, in two or more paths for which it was searched by said path planning means based on the evaluation result by said path evaluation means.
[Procedure amendment 4]

[Document to be Amended] Specification
[Item(s) to be Amended] 0009
[Method of Amendment] Modification
[Proposed Amendment]
[0009] Moreover, with the path planning equipment for mount of claim 5, it sets to claim 3 or 4. Said travel-speed storage means, said signal stop-time storage means, and said stop time amount storage means memorize data in the time-of-day unit set up beforehand. Said path evaluation means The passage time of day of a path Or let it be a summary to make it correspond to departure time and to evaluate a path based on the data of the time-of-day unit of said travel-speed storage means, said signal stop-time storage means, and said stop time amount storage means.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0010
[Method of Amendment] Modification
[Proposed Amendment]
[0010]
[Function] With the path planning equipment for mount of claim 1, whenever it passes through one joint road, the travel speed is memorized for the travel-speed storage means. That is, the information about the road through which it passed is held. And in case the path from the current position to the destination is chosen, in two or more paths for which it was searched by the path planning means, the mean velocity of each path is calculated based on the data of the travel speed in each joint road where a mean velocity operation means constitutes the path concerned held at the travel-speed storage means. Then, a routing means chooses the highest path of mean velocity. For this reason, the path it can run at the highest rate is chosen.
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0012
[Method of Amendment] Modification
[Proposed Amendment]
[0012] With the path planning equipment for mount of claim 3, whenever it passes through one joint road, a travel-speed storage means memorizes a travel speed, the time amount in which the signal stop-time storage means carried out a signal halt at the crossing is memorized, and the time amount which the stop time amount storage means stopped by the joint road is memorized. That is, the information about the road through which it passed is held. The travel speed in each joint road where a path evaluation means constitutes the path concerned currently held at the travel-speed storage means about two or more paths for which it was searched by the path planning means in case the path from the current position to the destination is chosen, It evaluates based on the signal stop time in each joint road which constitutes the path concerned currently held at the signal stop-time storage means, and the stop time amount in each joint road which constitutes the path concerned currently held at the stop time amount storage means. And a routing means chooses the path in which evaluation is the highest, in two or more paths based on the evaluation result by the path evaluation means. For this reason, the most suitable path can be elected.
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0014
[Method of Amendment] Modification
[Proposed Amendment]
[0014] A travel-speed storage means, a signal stop-time storage means, and a stop time-amount

storage means memorize data in the time-of-day unit set up beforehand, and a path evaluation means makes it correspond to the passage time of day or the departure time of a path, and evaluates a path by the path-planning equipment of claim 5 for mount based on the data of the time-of-day unit of a travel-speed storage means, a signal stop-time storage means, and said stop time-amount storage means. Although the flow of the vehicle on a path changes with time of day, it can choose the most suitable path with the path planning equipment for mount of claim 5 according to passing time amount.

[Procedure amendment 8]

[Document to be Amended] Specification

[Item(s) to be Amended] 0057

[Method of Amendment] Modification

[Proposed Amendment]

[0057] Moreover, since the path planning equipment for mount of claim 3 estimates a path based on the travel speed in each joint road which constitutes a path, a signal stop time, and stop time amount, the optimal path can be elected.

[Translation done.]